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See Page 593

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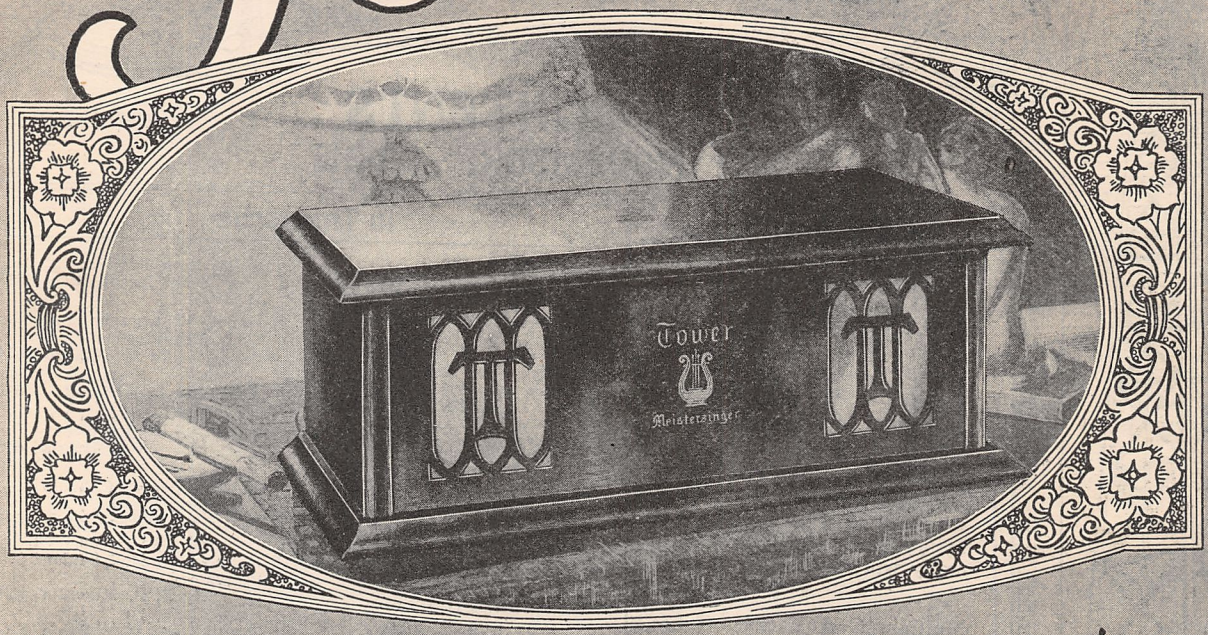

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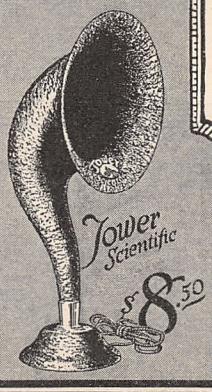

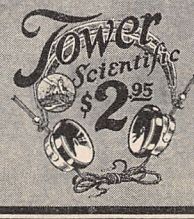

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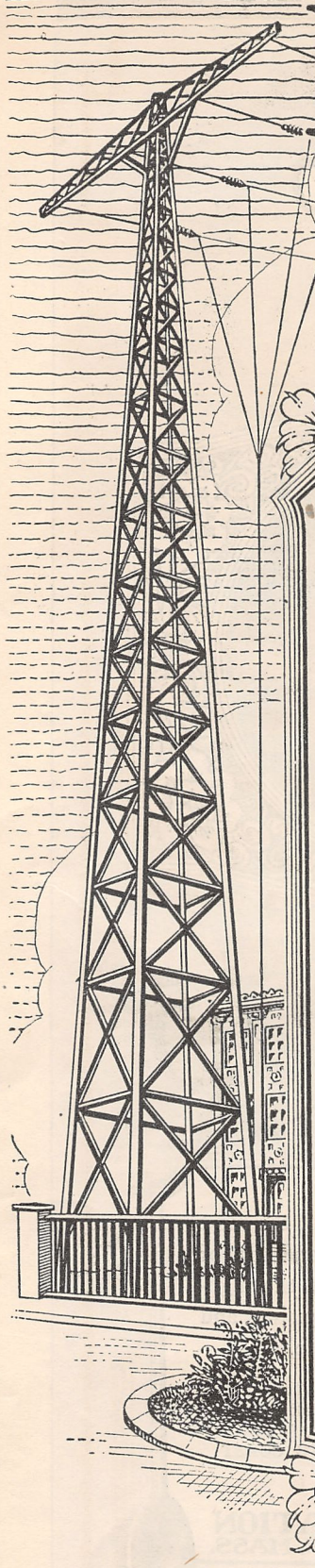

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VOLUME 7 NUMBER 5

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The Regenerative Interflex.

A further development of the new real single-control radio receiver circuit developed by Mr. Hugo Gernsback. To the good features of the first designs is added that of regeneration.

* * *

Is Lightning A.C. or D.C.?

A much mooted question whereon the present writer, Henry Hull, has some ideas really worth noting.

* * *

Multiple Grid Vacuum Tubes.

Multi-grid vacuum tubes have attained wide popularity in Europe, but are practically unknown here in America among the B. C. L.'s. An article by Theodore H. Nakken describes the application and use of these highly efficient tubes.

* * *

A New Phenomenon of the Aurora Borealis.

The renowned Aurora is continually doing things to mystify us. Here is a new one that the writer has discovered, dealing with the effects of the Aurora on long telephone lines.

* * *

The KIROVOX.

An exposé of an instrument claimed to be a panacea for all ills.

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"A great big beautiful set"

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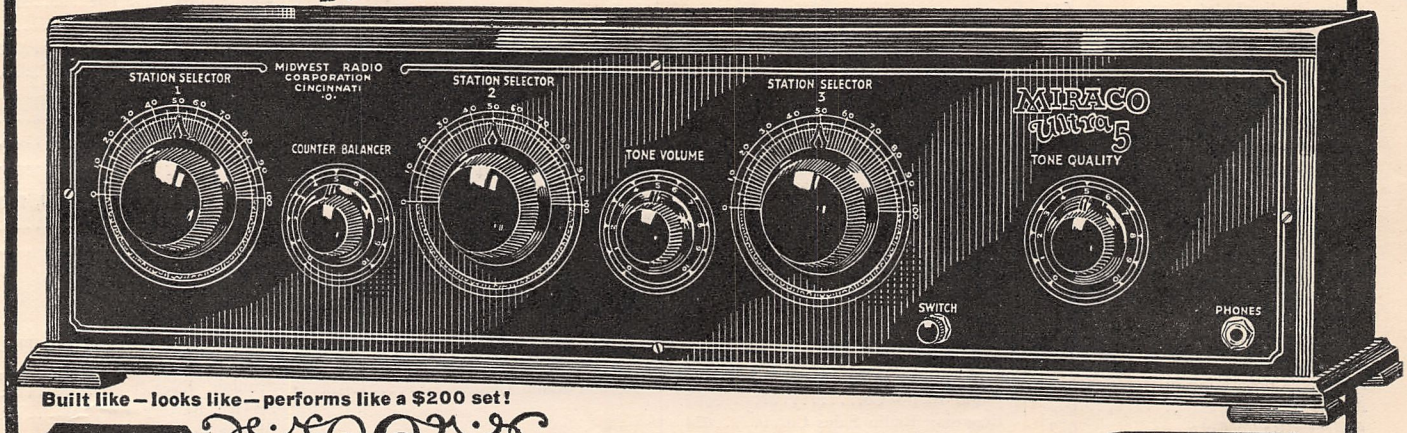


Built like—looks like—performs like a $200 set!

MIRACO RADIO GETS 'EM COAST to COAST

Notice!

Enormous demand for the celebrated Miraco Ultra 5 (resulting from its many enthusiastic users so highly recommending it to their friends) has enabled us to add hosts of costly new features, latest refinements and up-to-the-minute improvements such as you might expect to find only on the newest sets selling at much higher prices. So the Improved Ultra 5 for 1926 is even a better set—a more beautiful set—a more selective and more powerful set—incredible as this may sound!—for less money than ever before.

Reports from Ultra-5 users everywhere leave little for us to add. These are typical of the many in our files and which we receive daily:

Wins in Distance and Tone

The Miraco five-tube has all the other five-tube radios beat by a mile. All my friends have radios, but they can't get distance or clear tone as I can with mine. I have about 65 stations now and I get them as far as Oakland, Los Angeles, Calgary, Miami, Fort Worth, Omaha, and a lot more. Leon J. . . . . Buffalo, New York.

Utah Hears Coast to Coast

My Miraco Ultra-5 is a marvel. Directly I got it hooked up I got Zion, Ill., loud and clear on loud-speaker, and have had a great number of stations coast to coast since, all coming in on loud-speaker very clear. I consider it one of the best sets I have heard and am greatly pleased with it. John R. . . . . , St. George, Utah.

Pennsylvania Hears California Very Loud

I received the Ultra "5" Set, set it up as directions called for, and received Dallas, Texas, first station. Will list a few of the stations received in two hours: KDKA, WHAS, WOR, WOAW, WOS, WTAM, WCAE, WOO, WJY, WJS, KFI, KSI, WWJ, WHN, WHX, NSCX. It is very easy for me to receive Los Angeles, California, loud enough to be heard in any room in the house. W. E. . . . . , Uniontown, Pennsylvania.

California Gets New York on Loud-Speaker

I have got stations from coast to coast without any trouble at all on Ultra-5, WTAM, Cleveland, Ohio, comes in on loud speaker nearly as loud as the near-by stations do. I have brought in on loud speaker with ample volume to hear all over the room stations WEAF, N. Y., KDKA, Pittsburg, Pa., WGY, New York, CHCX, Ottawa, WSAI, Cincinnati, WCCO, St. Paul, Minnesota, WLS, Chicago. S. S. . . . . , Dorris, Calif.

"Greenhorn" Hears Stations Everywhere

To date have had about fifty stations on the Ultra-5 including Los Angeles, Havana, Winnepeg, Boston, etc. Which is going some for a greenhorn I think. Lynn C. . . . . Bowling Green, Ohio.

New Jersey Hears California on Loud-Speaker

MIRACO Ultra "5" working fine. Have received Western coast. Had two stations in California on same night. Have had many other stations. Receive all stations with loud-speaker. Nivison Van . . . . . Freehold, New Jersey.

Radio Expert Speaks from Experience

As I sell almost all kinds of sets, I have operated all of them and will state that the Miraco Ultra-5 is as good if not better than any other set in the market today. Felix J. . . . , Pawtucket, R. I.

Prefers it to $150 Sets

I received your Miraco Ultra 5 Radio Set, and it surely is a peach. I have tried and heard radios up to the value of $150.00 but I like yours the best. William I. . . . . , Syracuse, New York.

Illinois Hears Alaska

The night I received the Ultra "5" I tuned in New York City. The second day I tuned in KFJ Los Angeles, Calif., and KFJ Junea, Alaska. Can get anything in the United States. I will put it against any set I have ever heard. H. H. . . . Ashkum, Illinois.

Got California Better Than $269 Set

Received the Miraco Ultra-5 the other day and it is a big surprise. Compared it with my friends' $269.00 . . . . and could bring them in just as loud and clear on my Ultra-5. Really I brought in Los Angeles, California on speaker louder than he did. Kyle . . . , New Albany, Miss.

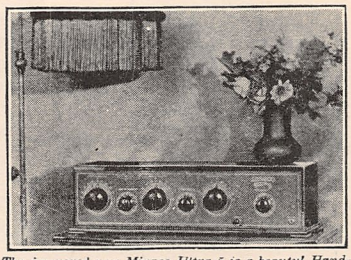
The Powerful New MIRACO Ultra 5

Now only $59.50 Retail

Send for Special Offer!

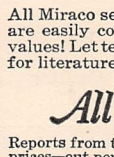
[FIVE TUBE SET IN BEAUTIFUL MAHOGANY CABINET]

Let the testimony of its many users everywhere—as voluntarily reported to us in writing—convince you that a Miraco Ultra-5 actually is unsurpassed for selectivity, long distance range, clear tone, loud speaker volume and beauty—combined with economy and simplicity of operation—at several times the price. Send coupon for plenty of this proof and reports of users which leave no doubt that the Miraco Ultra-5 gets programs coast to coast as well as from foreign countries.

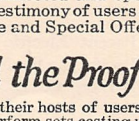


The improved new Miraco Ultra-5 is a beauty! Handsomely gold-etched genuine Formica panel and large Bakelite knobs with "arrow-point" indicators (for fine tuning) add to the stylish appearance. Mahogany cabinet is hand rubbed. A radio you will be proud to have your friends see.

Completely built, carefully tested and factory guaranteed by one of America's oldest and most successful makers of quality sets, the Miraco Ultra-5 illustrated above (latest improved model for 1926) in the opinion of radio experts is an astonishing bargain. Selectivity, long distance reception, clarity and volume have been amazingly increased—"B" battery consumption is minimized—oscillations are easily controlled on all wavelengths, through use of latest radio inventions. Among these are: "Duoformers" (ultra low-loss inductance coils); the "Counter-Balancer" (patented); flexible wiring which prevents broken or noisy connections; an adjustment for different length aerials; use of only two rheostats; a cut-out switch; concealed wiring under genuine Formica sub-panel and other features of costliest sets. Literature describes them fully. Send for it—and Special Offer!



Other Miraco Long Distance Sets $13.75 up retail



Wonderfully improved new models in one-tube and three-tube Miraco Long Distance Sets also ready at lower prices! Powerful new Miraco R-3 at only $27.35 (retail) operates loud speaker on distant stations. New one-tube Model R is also a record-breaker for distance at $13.75. All Miraco sets work on storage or dry batteries, are easily connected and operated. Unmatched values! Let testimony of users convince you. Write for literature and Special Offer—use coupon.

AGENTS! DEALERS!

Write for the new Mirac proposition. Nation-wide use and popularity of Miraco sets, coupled with their amazingly low prices, make them wanted everywhere. Easy to sell—due to their wonderful tone, volume and distance-getting. Send coupon today!

All the Proof you want is waiting for You!

Reports from their hosts of users in every state prove Miraco sets—at their rock-bottom factory prices—out perform sets costing up to three times as much. Send for latest literature, SPECIAL OFFER and plenty of additional testimony from users leaving no doubt that "Miraco Radio Gets 'em Coast to Coast."

Send coupon for free bulletins AND SPECIAL OFFER

MIRACO RADIO GETS 'EM COAST to COAST

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets
Cincinnati, Ohio

404-H East Eighth Street

Send free literature, SPECIAL OFFER and all particulars regarding Miraco Sets.

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No matter if you know nothing about Radio now, you can quickly become a Radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date Receiving Sets.

PAY INCREASES OVER $100 A MONTH

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.

(Signed) A. N. LONG,
Greenburg, Pa.

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I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.

T. WINDER,
Grand Junction, Colo.

FROM $15 TO $80 A WEEK

Before I enrolled with you I was making $15 a week on a farm. Now I earn from $2,080 to $4,420 a year, and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000, and I believe the course will be worth at least $100,000 to me.

(Signed) GEO. A. ADAMS,
Tamaqua, Pa.

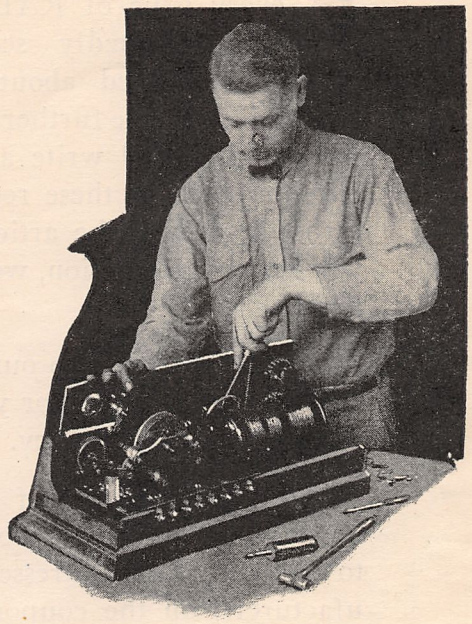
Scores of young men who have taken our course are already earning from $75 to $200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100% *even while taking our course!* Emmett Welch, right after finishing his training, started earning $300 a month and expenses. Another graduate is now an operator of a broadcasting station—PWX of Havana, Cuba—and earns $250 a month. Still another graduate, only 16 years old, is averaging $70 a week in a Radio store.

Wonderful Opportunities

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer." "We want men with executive ability in addition to Radio knowledge to become our local managers." "We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating, easy work—a chance to travel and see the world if you care to, or to take any one of the many Radio positions all around you at home. And Radio offers you a glorious future!

The National Radio Institute is one of America's Pioneer Radio Schools—established in 1914. Our course is an absolutely complete one which qualifies for a government first-class commercial license. It trains you for *bigger* paying jobs in Radio.



Send for FREE RADIO BOOK

Learn more about this tremendous new field and its remarkable opportunities. Learn how you can quickly become a radio expert and make big money in Radio.

We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing, practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it *now!*

For a short time we are offering a reduced rate to those who enroll at once. Act promptly and save money.

National Radio Institute
Dept. 13NB
Washington, D. C.

NATIONAL RADIO INSTITUTE,
Dept. 13NB, Washington, D. C.

Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special Free Employment Service. Please write plainly.

Name.....

Address.....

City..... State.....

RADIO NEWS READERS' BUREAU

Time and Postage Saver

IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in RADIO NEWS.

If there is any Manufacturer not advertising in this month's issue of RADIO NEWS, from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

READERS' SERVICE BUREAU, RN-11-25
Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of RADIO NEWS.

DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

NAME	ADDRESS (Street — City — State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

NAME	ADDRESS (Street — City — State)	

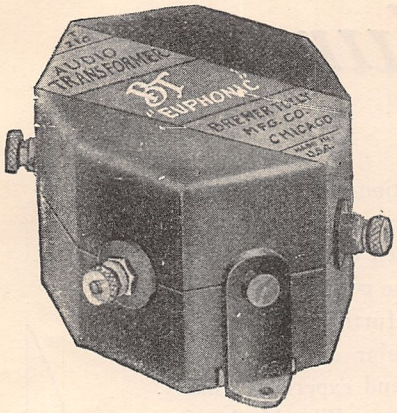
Your name .....
Your address .....
☐ If you are dealer check here. City ..... State.....

Dealer's name .....
His address .....
City..... State.....

FARTHER AHEAD THAN EVER

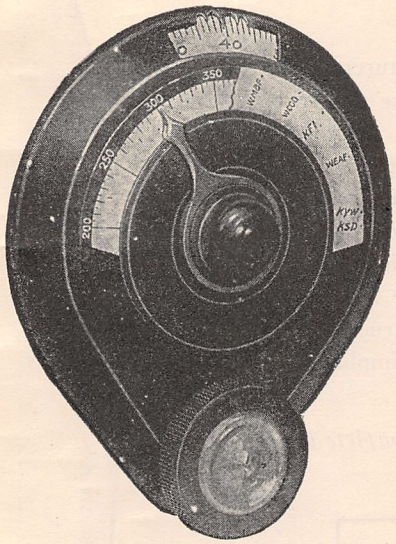
B-T EUPHONIC

"Pleasing to the Ear"



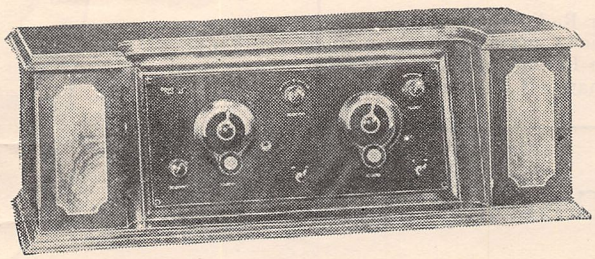
In addition to surpassing merit as an audio amplifier, the B-T "Euphonic" brings to Radio the first constructional improvement in many years. Movable legs that snap into place in either position allow mounting either side up, above or below your baseboard. The result is shortened leads—no crossed wires and consequent elimination of the howling and distortion often caused thereby. The Euphonic will add luster to the already shining shield of Harry A. Bremer, its designer, who built his first wireless apparatus just 20 years ago.

Two Radios 2.2 to 1, **$5.00**
5.9 to 1, **$5.75**



The B-T Tuning Control

The Tuning Control is another original example of B-T ingenuity. Better action and better appearance tell the story. Reads in degrees, wavelengths or call letters. Price **$2.50**

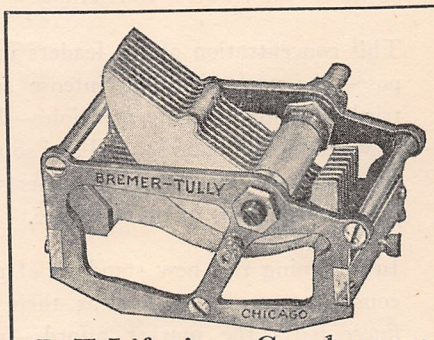


The Original B-T Nameless Receiver

The original B-T Nameless was about two years ahead of its time. It's only now that the correctness of its principles are coming to be properly appreciated. Thousands will build the Nameless this season, and tens of thousands will build and enjoy the unequalled "Counterphase." Six tubes, including three of radio frequency, with only two tuning controls. Long-distance loud-speaker reception with short indoor antenna.

Sold as 5 or 6 tube kits or complete receivers.

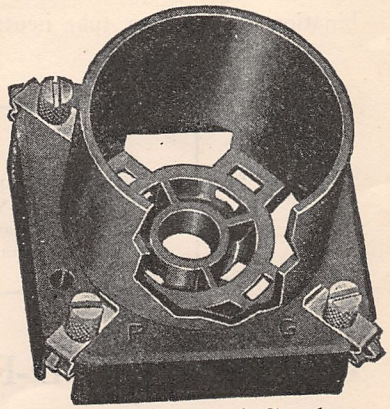
The oversize 8th Edition of "Better Tuning" is the best dime's worth of radio information you ever read. Send for it today.



B-T Lifetime Condensers

All the world knows and recognizes the outstanding superiority of B-T "Lifetime" Condensers. The S.L.F. type follows the same original design. The bearing alone is enough to win your approval. None other even approaches it.

SLF-13, .00025 (for B-T Bankwound coils) **$5.00**
SLF-17, .00035 (for B-T Torostyles) **$5.75**



B-T Universal Socket

The B-T Universal Socket fits both large and small UX tubes and all UV except the old style 199 without an adapter.

The contact tells its value. Look once and you'll choose it. Price **75c**

RN

☐ Send free circulars
☐ Send "Better Tuning," 10c enclosed
☐ Send information on complete receivers.

Name .....
Street .....
Town..... *State*.....

BREMER-TULLY MFG. CO. CANAL AND HARRISON STS. CHICAGO ILL.

Approved by ten leading manufacturers

THE new Hammarlund-Roberts receiver is the united achievement of ten leading engineers, endorsed by ten of the best-known radio manufacturers. No one man's or one group's conception of five tube possibilities but the composite of the leaders' convictions.

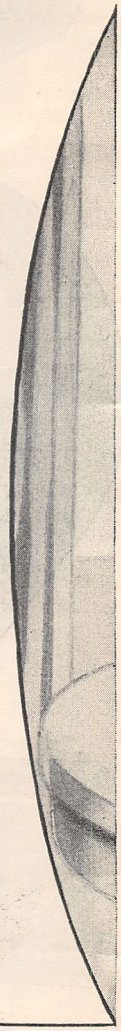
This concentration of the leaders upon one purpose—the perfection and intense application of tried and proven radio principles—has produced new results. Results so vital and so valuable that they put the Hammarlund-Roberts far beyond your expectations of performance.

In designing this new standard of efficiency, the consulting engineers had at their disposal the finest parts the market affords—regardless of cost—they were not handicapped in building to a price.

The outstanding merit of the original Roberts Circuit was its use of regeneration (the equivalent of two stages of radio frequency) in combination with proper tube neutralization. This hitherto unattainable combination provided maximum range, sensitivity, perfect tone and easy, non-critical tuning. It banished the former bugbears of radiation. Ten of the country's leading engineers collaborated on still further refinements and elaborations of this popular circuit. This union of principles, opinions and experiences has clarified hitherto cloudy points. The ideals of all these experts have been pooled in this one model radio receiver.

These ten leading manufacturers offer to the American public greater value than ever before. A radio receiver constructed throughout of the latest, most efficient part designs at a price within the means of every one. A five tube receiver that equals the Super-Heterodyne in selectivity and volume. A receiver so simple in design that anyone can build it from the instructions in the "Hammarlund-Roberts Construction Book." You will wonder at this new simplicity; this new efficiency; this new saving.

Write for this most complete book.

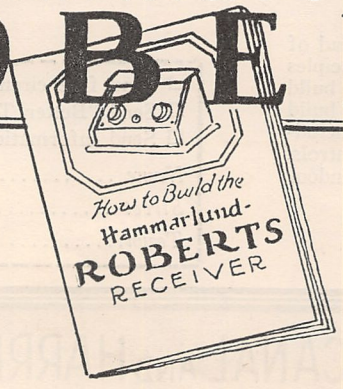


Associate Manufacturers

All-American Radio Corp.	Carter Radio Company
Hammarlund Mfg. Co., Inc.	Dubilier Condensers
Alden Manufacturing Co.	Union Radio Corp.
Radiall Company	International Resistance Co.

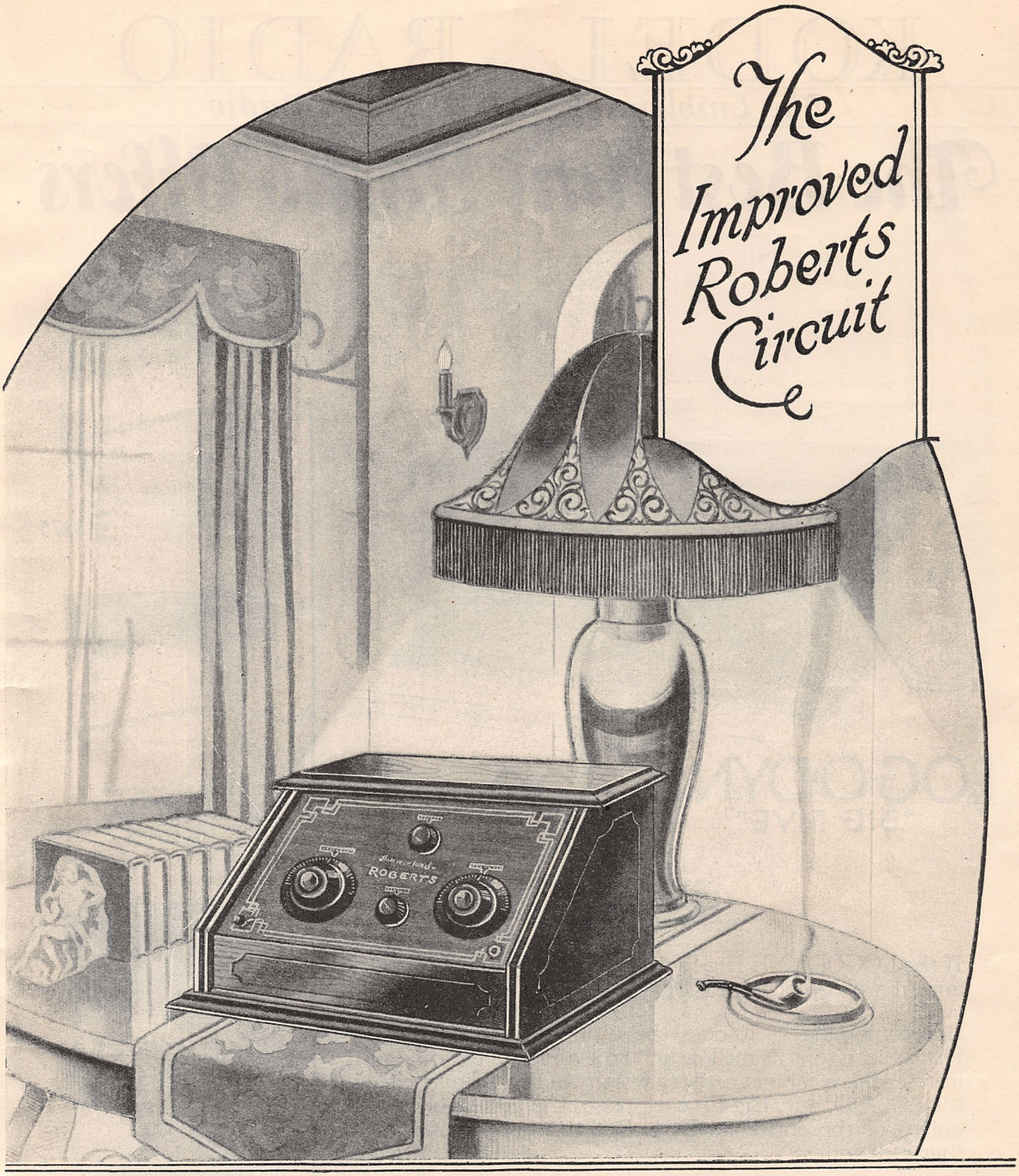
HAMMARLUND-ROBERTS, 1182-C Broadway, New York

Hammarlund-ROBERTS



Write for this most complete book giving complete details on assembling, wiring and operating the Hammarlund-Roberts receiver.

25c



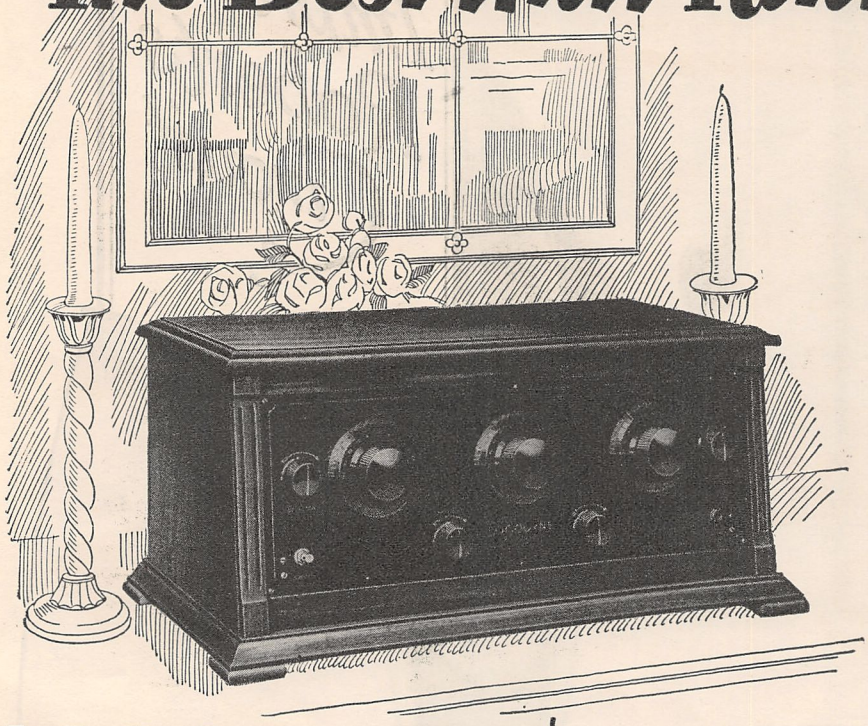
$60.85 Cabinet Extra

The All-American Radio Corp. contribute the Rauland Lyric Transformer to the efficiency of this new receiver.

KODEL RADIO

The Emblem of KRC *Worth in Radio*

The Best that Radio Offers



LOG·O·DYNE "BIG FIVE" $90.00

Five tubes, self-balanced tuned radio frequency; sloping panel gold engraved; beautiful, massive, Adam brown mahogany cabinet; compartment for batteries; stations already logged for easy tuning.

If the LOGODYNE Big Five excelled only in performance it would not be a KODEL RADIO.

But combining as it does the ultimate in good performance, a tone as mellow and true as a rare old music instrument, a cabinet artistry worthy of the old masters the LOGODYNE Big Five expresses the perfection required of the entire KODEL RADIO line—the best that radio offers.

Free *Send for the new edition of our free booklet "The Secret of Distance and Volume in Radio". Gives helpful interesting information on radio operation.*

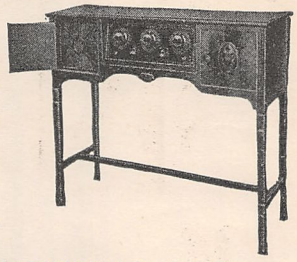
THE KODEL RADIO CORPORATION

501 East Pearl Street Cincinnati, Ohio

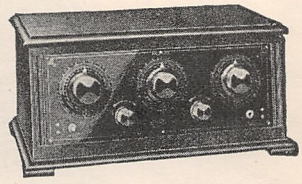
WKRC

Owners of Kodel Broadcasting Station WKRC on the Alms Hotel. Send for program.

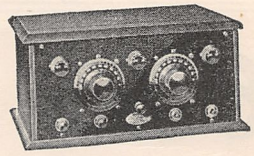
LOGODYNE "Big Five" Console Model—the Aristocrat of Radio; built-in loud speaker, compartment for batteries and charger a masterpiece in furniture design. $275



LOGODYNE "Standard Five" Console Model—beautiful brown mahogany; built-in loud speaker; compartment for A and B batteries and charger..... $165



LOGODYNE "Standard Five" —five tubes self-balanced tuned radio frequency; gold engraved panel and sub-panel; battery compartment; handsome brown mahogany cabinet..... $70



KODEL "Gold Star" Models—Radio's greatest set values;

Three Tube "Gold Star" Model. $30

Two Tube "Gold Star" Model.. $20

One Tube "Gold Star" Model... $12

"Gold Star" Crystal Set..... $ 6

The slow 2-ampere battery charger is as obsolete today as the old "one-lunger" of 1903

Buy nothing but an up-to-date 5-ampere charger!

The New Improved

5 AMP. A & B GOLD SEAL HOMCHARGER

$19.50

Over 500,000 already in use

Charges 150% Faster!

Better Because:—

New micrometer adjustment, hinged lid, and carrying handle.

No bulbs to buy or break.

Can be used anywhere—contains no acids or other harmful liquids to spill.

Approved by underwriters—trouble-proof, shock-proof and fireproof.

Beautiful cabinet in maroon and gold.

Free *Write for new edition of our instructive booklet on radio operation "The Secret of Distance and Volume in Radio."*

It takes only one-third as long to charge a battery with the New Improved GOLD SEAL HOMCHARGER. The big, healthy 5-ampere charging rate does away with the long bothersome waits that were necessary when the obsolete slow 2-ampere charger was the best that radio offered.

The New Improved GOLD SEAL HOMCHARGER charges 150% faster—will charge your battery overnight! **And it charges both A and B batteries without additional equipment.**

Don't let anybody sell you a slow 2-ampere charger—they are obsolete—out-of-date. You need a modern charger with a full 5-ampere rate. Insist on the GOLD SEAL HOMCHARGER.

The Kodel Radio Corporation

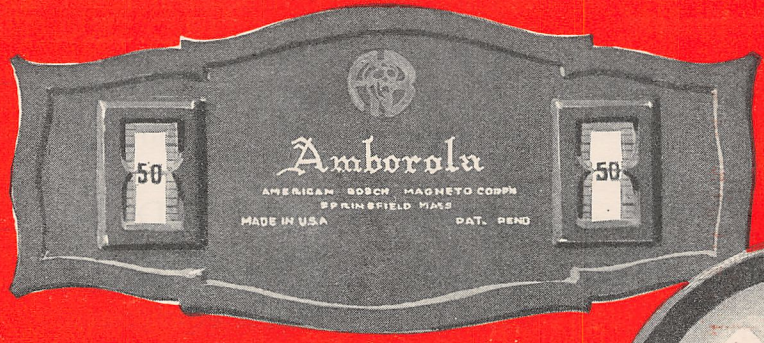
501 East Pearl Street **Cincinnati, Ohio**

WKRC

Owners of Kodel Broadcasting Station WKRC on the Alms Hotel. Send for program.

BOSCH

50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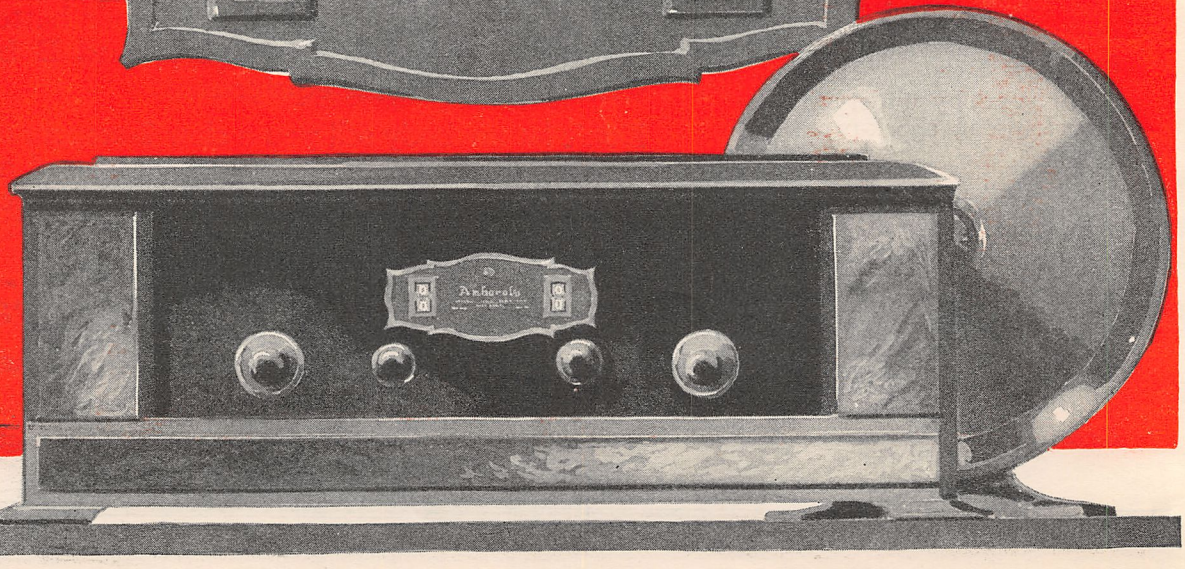
Amborola
AMERICAN BOSCH MAGNETO CORP'N
SPRINGFIELD MASS
MADE IN U.S.A.
PAT. PEND
50


Amborola

RADIO

BOSCH RADIO BACKGROUND

The American Bosch Magneto Corporation is in position to build radio products of unapproachable quality. This organization comprises skilled electrical engineers, workmen experienced in precision manufacture, a world wide service and distributing organization all backed by plant, tools and equipment especially designed for the manufacture of precision electrical apparatus.

Bosch quality is world famous.

This is the incomparable background of Bosch Radio Products—the Amborola Receiving Set, the Ambotone, and the Junior Ambotone Reproducers — all reflecting Bosch quality in design, manufacture and performance.

AMERICAN BOSCH MAGNETO CORPORATION
SPRINGFIELD - - MASSACHUSETTS

A Lacault Development

TO the radio-wise, the mere fact that the designer of this new kind of receiver is R. E. LACAULT is a sufficient recommendation. This famous technician has frequently lead the forward march of radio. His popularity is founded on the recognition of his intense practicality. He is no mere theorist! He never misleads, never entangles with useless technicalities. He perceives the requirements of the average radio user and designs in strict accordance with these practical requirements. The result is always complete satisfaction. This new type receiver is the realization of Lacault's fondest ideals of radio reception.

Specifications

Circuit—The new ULTRADYNE Model L-3 employs six vacuum tubes of the six volt, one-quarter ampere type. The first three function as radio frequency amplifiers, the fourth as detector and the last two as audio frequency amplifiers. Operation has been simplified by using automatic filament controls in place of rheostats. The first two stages of radio frequency amplification are tuned while the third stage is fixed.

Selectivity—A special resistance system of stabilization prevents these circuits from oscillating at resonance points. More than this, the system actually increases the selectivity of the set without any loss in efficiency. Though the set is so highly selective, there are none of the "critical tuning characteristics" common to so many receivers, due to the use of straight-line wave length condensers. The lever system of control provides a vernier action of a new order.

Matched Loud Speaker and Amplifier Units—Distortion has been eliminated by striking an equality in the impedance of the loud speaker unit and the plate to filament impedance of the tubes. The two work in perfect harmony with each other. The new ULTRADYNE is designed to use either an indoor or an outdoor aerial. For most purposes an indoor wire is sufficient. A section of lamp cord run around the moulding of a room is very satisfactory.

Cabinet—The cabinet is 24 inches long, 14 inches high and 14 inches deep. Space is provided for the "B" batteries on the inside. Binding posts on the rear of the vacuum tube socket sub-base take the aerial, ground and "A" battery connections which are run through holes in the back of the cabinet. The wood is a rich, brown color, made up of five-ply mahogany veneer and decorated with two-tone line cuttings. DUCO finished to guarantee the permanency of color, grain and lustre. The grill in the center, which conceals the loud speaker horn, is a statuary bronze color and is backed by a meshing of dull gold.

Guaranteed

To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on the assembly lock-bolts of all genuine ULTRADYNE Model L-3 Receivers. All Receivers are GUARANTEED so long as these seals remain unbroken. No equivocation about this GUARANTEE. This seal is as positive in its protection as a bank note. As long as you refrain from tampering with it, the ULTRADYNE, Model L-3, will be maintained in perfect condition by its makers.

R E L

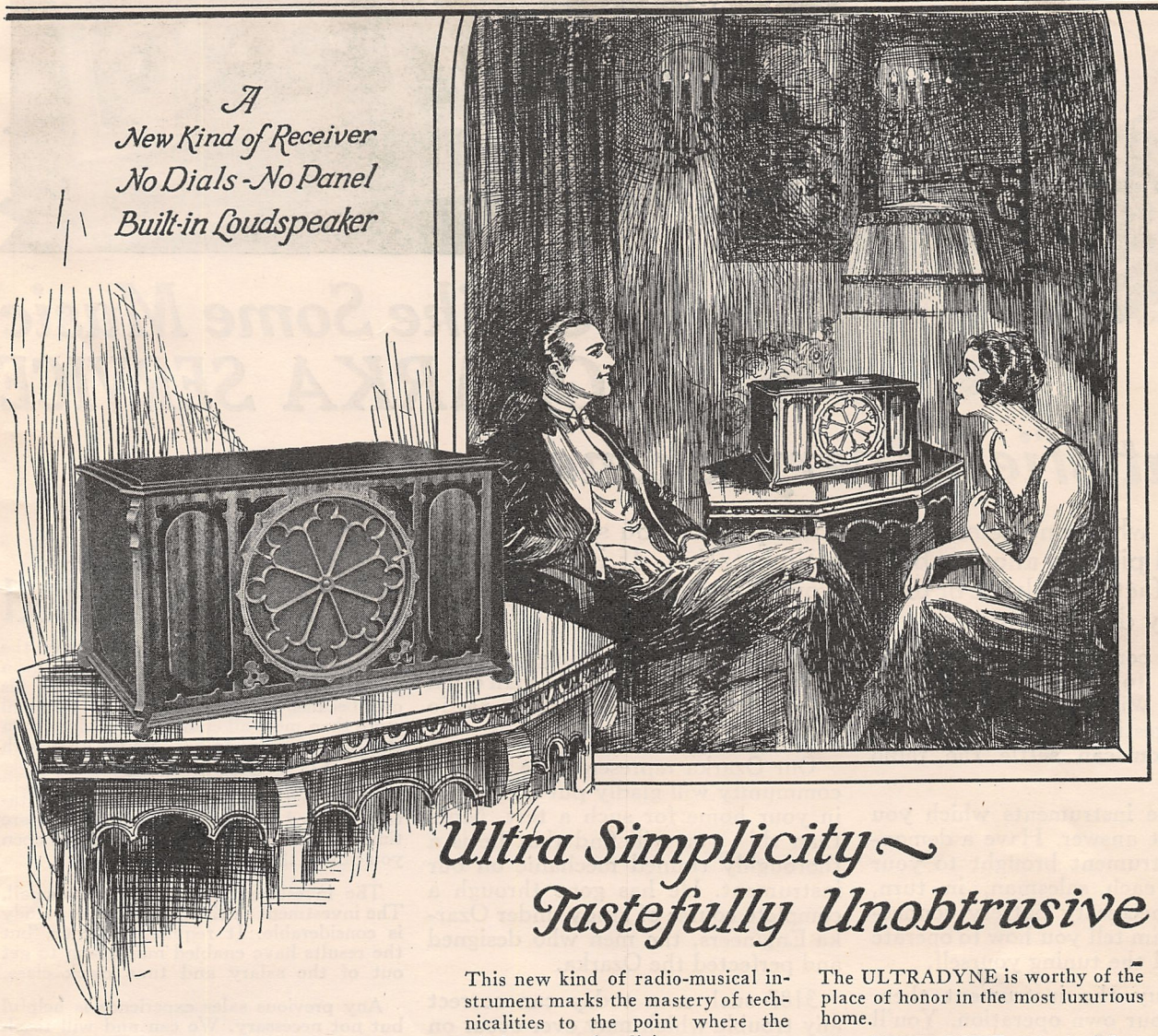
ULTRADYNE
MODEL L-3

PHENIX RADIO CORPORATION 114 EAST 25th ST., NEW YORK

No Dials-No Panel-Built-in Loudspeaker

A New Conception of Radio

A
New Kind of Receiver
No Dials - No Panel
Built-in Loudspeaker



Ultra Simplicity ~ Tastefully Unobtrusive

This new kind of radio-musical instrument marks the mastery of technicalities to the point where the whole range of radio's resources are literally at your instant command.

The ULTRADYNE, Model L-3, supplants the usual "laboratory machine." It is a new artistic tablepiece that makes the entrance of radio into the well-appointed home *unobstrusive, inconspicuous.* It represents the triumph of art over mere mechanics.

The ULTRADYNE is worthy of the place of honor in the most luxurious home.

The ULTRADYNE, Model L-3, fulfills everything that the critically-minded have demanded of radio. Why wait any longer, why deny yourself the infinite treasures of radio? The ideal has at last been attained.

Skepticism will vanish if you will allow your local dealer to demonstrate this new modern radio receiver.

Illustrated Folder on Request.

$135.00

ULTRADYNE
MODEL L-3

PHENIX RADIO CORPORATION 114 EAST 25th ST., NEW YORK

Beauty in Tone - Beauty in Design

$125.00
Complete with all Accessories
10% Additional West of Rockies.

Unlike Some Music OZARKA SERVICE Satisfies Every Owner—

IN radio, when one selection does not please, you simply tune it out and pick up another broadcasting station. If it is a matter of unsatisfactory volume or tone in your instrument then it becomes an entirely different matter.

You have certain very definite ideas in mind as to what you want your radio to do. Will you allow us to make a few suggestions regarding a plan whereby you can settle the radio question?

Select the instruments which you think might answer. Have a demonstrating instrument brought to your home. Let each salesman, in turn, make the necessary battery connections. Let him tell you how to operate it but do all the tuning yourself.

You'll buy the instrument then, based on your own operation. You'll size up each one for

—ease of tuning
—distance received
—volume
—tone
—selectivity
—price.

There still remains one very important question to settle—the matter of service. No matter what anyone tells you sometimes little things may go wrong. The best radio salesman often knows nothing of correcting radio troubles—satisfy yourself.

Our Ozarka representative in your community will gladly put an Ozarka in your home for such a test. More than this, you will find that he is a thoroughly trained mechanic on our instrument. He has gone through a complete course of study under Ozarka Engineers, the men who designed and perfected the Ozarka.

3187 such men today can correct any trouble which may ever occur on any Ozarka instrument—more men are being factory trained daily. You wouldn't buy an instrument blindly—then don't buy service the same way. Any radio instrument is only as satisfactory as the quality of service behind it.

Our Book No. 200 shows the full Ozarka line from $75.00 to $197.50, complete with all accessories.

A Few More Men are Needed

In a great many counties we have the man we want. He is rapidly building up a permanent and profitable business of his own because he has an instrument that will more than meet all competition. More than this, he is trained to back up his sales with the kind of service that counts.

Many well established Ozarka representatives started by giving us only their spare time—their evenings. If your county is open you can do the same.

The investment in cash is very small. The investment in time necessary for study is considerable. It requires patience, but the results have enabled many men to get out of the salary and time clock class.

Any previous sales experience is helpful but not necessary. We can and will teach you how to sell.

Send for 64 Page Book— "The Ozarka Plan"

This book is entirely too expensive to be sent out on postal card requests. It will be sent FREE to any man who mails the coupon below and who is really anxious to improve his condition. Tell us about yourself—ask for Ozarka Plan No. 100 and don't fail to give the name of your county.

OZARKA
122 Austin Avenue E
Chicago, Illinois

Gentlemen: Without obligation send book "Ozarka Instruments No. 200" and name of Ozarka representative.

Name.....
Address..... City.....
County..... State.....

Ask the Man Who Wears this Button

INCORPORATED
122 Austin Avenue E
Chicago, Illinois

Gentlemen: I am greatly interested in the FREE book "The Ozarka Plan" No. 100, whereby I can sell your radio instruments.

Name.....
Address..... City.....
County..... State.....

RADIO NEWS

H. GERNSBACK, Editor and Publisher
SYLVAN HARRIS, Associate Editor

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 7 NOVEMBER, 1925 No. 5

WHO PAYS FOR RADIO BROADCASTING?

By HUGO GERNSBACK

NOW that radio has become quite stabilized, not only in the set building and parts manufacturing industries, but in broadcasting as well, we very often hear the question: "Who pays for broadcasting?" The public wonders, and asks all sorts of questions, and has all sorts of ideas. In fact, no end of rumors are afloat about broadcasting in general.

Radio broadcasting may be said to fall into two classifications: non-commercial broadcasting and commercial broadcasting. The non-commercial braodcasting is done by individuals or organizations which broadcast without direct monetary gain, although there is, as a rule, an indirect gain of some sort.

When a newspaper or a publisher of magazines owns a broadcast station, it is usually operated with the idea of increasing the circulation of the publications. In other words, the station is broadcasting propaganda. If a church or educational institution is doing non-commercial broadcasting it is with the idea of gaining as many listeners as possible, in the hope that the listeners will sooner or later "come into the fold." This, in other words, is simply propaganda.

If a department store owns a broadcast station, obviously its use is simply that its listeners will be impressed by the name of the store that operates the station.

The non-commercial broadcaster has a ticklish job, insofar as he can not put over his propaganda in a crude and undignified manner. Suppose a large department store has a broadcast station. How long would listeners stand for it if the department store were to praise its wares in almost every sentence? Nothing like this, of course, ever happens. The department stores, the newspapers and other non-commercial broadcasters are usually content just to get their publicity into the announcement, which may take the following form: "This is Station WXYZ, the John P. Doe Department Store. Our next selection will be——," etc.

Few broadcast stations resort to the use of direct advertising of their wares, although it seems to be ethical with newspapers to call attention to certain news as published in such-and-such a newspaper. News, in other words, is supposed to be a different kind of commodity from a cake of soap or a pair of silk stockings. On the other hand, it seems to be ethical for broadcast stations owned by department stores to institute prize contests occasionally in which well-known merchandise is given away to broadcast listeners.

All in all, the non-commercial broadcaster has not any easy job facing him. The broadcast station is usually charged up to advertising by the bookkeeping department, and only a certain sum is appropriated, which, as a rule, is not exceeded. The station, having no income, cannot go out and hire artists, so all the broadcasting of the non-commercial stations must be done by volunteer artists, who themselves are broadcasting for the publicity which they get from so doing. This, as a rule, works out harmoniously. The public, on the one hand, gets an excellent program by good artists, while the artists themselves get the advertising which they need. This is the reason why the non-commercial stations do not have to resort to any great amount of "raw" advertising over the air. As a matter of fact, a first-class station never does and never should. With the commercial stations, the situation is totally different. A commercial station is one which broadcasts for gain—quite frankly so. It solicits advertising from corporations and the form that the advertising takes is now well known. For instance, let us say, a manufacturer of electric batteries wishes to advertise its name to many thousands of radio listeners. The form that this advertising takes nowadays is somewhat as follows:

"This is Station WZXY, broadcasting the Everlast Battery Corporation Symphony Orchestra." The advertising is contained in this announcement and if it is repeated week after week it must sooner or later impress the listener that the Everlast battery must be a good battery, although the batteries themselves are never mentioned by name. The manufacturer of the battery knows that he must follow this up with the printed advertisement, and that the broadcast advertising is simply the forerunner to create good will and a "homey" feeling toward this particular battery.

The battery manufacturer in this case not only pays the broadcast station for the length of time he uses the station, but he has to pay the orchestra or artists as well. There is usually no fixed price for the artists or the orchestras, while there is a fixed price for broadcasting, as shown in the following paragraph. These happen to be the charges of one of the greatest commercial broadcast stations in the country—WEAF, of New York.

This station charges from $150 to $500 per hour, depending upon the use to which the station is put, the nature of the program, the hour of the day, etc. These are charges just for the one station. If, however, the entire net of 14 allied stations is tied in for one program from WEAF, the charge is approximately $2,500 per hour. This is exclusive of the cost of the entertainers and other incidental expenditures.

It will now be seen that the commercial broadcaster has a certain advantage over the non-commercial one, in that he can pay top prices, if necessary, for talent, and on account of this the public gets an excellent program. Also, for that reason, it does not mind the little advertising which makes the broadcasting possible. The public, in America particularly, is rapidly becoming used to this sort of thing and no longer objects to the slight advertising feature over the air, because it knows that this is a world where you cannot get something for nothing and if you wish to listen to an excellent program some one in the end must pay for it. That some one in the end is, of course, the public.

There is a lot of foolishness being pandered about that broadcast listeners do not pay for the programs. They certainly do in one way or another, sooner or later, even though they do not realize it. For instance, if you are a broadcast listener and have heard, all summer long, the Goldentone Cord Orchestra, and are in need of an automobile tire, sooner or later, this name will probably stick in your memory and you will ask for a Goldentone Cord Tire. It will therefore be seen that eventually you will pay your share of the broadcasting expense, which is as it should be. If you derive pleasure from the excellent programs you receive night after night, day after day, you naturally do not feel that you should get all this for nothing.

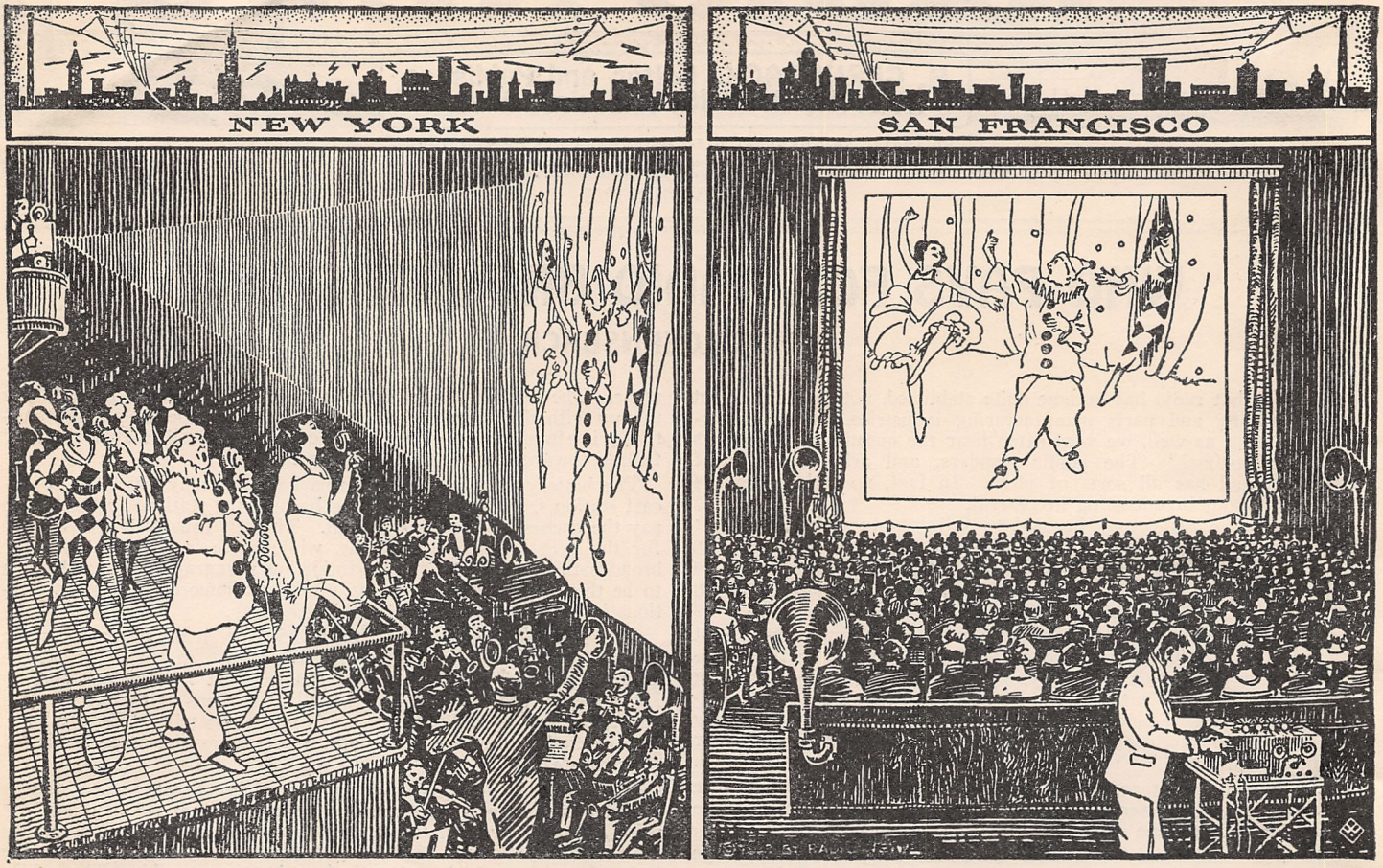
When you buy a newspaper, or when you buy a magazine, you get such publications at a reasonable cost for one and only one reason; namely, the advertisements contained in such newspapers and such publications. The reader, nowadays, knows that he could not buy his morning paper for two cents, nor his monthly magazine for twenty-five cents, if it were not for the advertising that these publications carry. The advertising, in other words, makes it possible for the newspaper and magazine to be sold at a reasonable price. We do not object to the advertisements in these publications, because we know that without them we could not get such a wealth of text and editorial matter.

Therefore, if your broadcast station gives you a wealth of "text and editorial matter," meaning entertainment, music, speeches, and what-not, all free of charge, without your having to pay any money whatsoever, why object to the little advertising that of necessity must go out on the air to make such entertainment possible?

In Europe they still have the idea that every broadcast listener must be taxed a certain sum in order that the broadcast stations may live. That this policy is foolish is best shown by the fact that there are some 600 stations in the United States alone, while all Europe does not boast of more than about 125. Besides this, there are at least a hundred times more broadcast listeners in this country than in Europe.

Mr. Hugo Gernsback speaks every Monday night at 9 P. M from Station WRNY on various radio and scientific subjects.

Radio and Movies



The above is our illustration reproduced from the September, 1919, issue of RADIO NEWS, giving Mr. Hugo Gernsback's prediction made in 1919 before broadcasting was known in the sense that we have it today. This shows his conception of the scheme whereby the artists of a Grand Opera Company could watch their action on one screen while the same picture was being shown simultaneously in movie houses all over the country, and how radio could be used to pick up the voices and orchestra to be broadcast to the various theatres where the opera was being shown. In other words, simply a scheme of direct opera by radio.

By COLEMAN GALLOWAY

SEVEN years ago Hugo Gernsback predicted in RADIO NEWS synchronization of the radio with moving pictures, linking the "silent drama" with the human voice over the air. Talking pictures, the films synchronized with phonographs, had been attempted, but never made commercially successful. A musical comedy was produced, but the result was mechanical and left the audience dissatisfied.

On August 24, 1925, Mr. Gernsback's prophesy was fulfilled; the talking picture had become a reality. In 15 theatres crowds sat almost bewildered, so uncanny seemed to be the perfect synchronization of the lip movements of the actors on the picture screen with the voices broadcast through the receiving sets on the stage.

Acting in collaboration with the Metro-Goldwyn-Mayer Corporation, the *Los Angeles Examiner* and Station KFI, Los Angeles, the West Coast Theatres presented in connection with a feature film a special film in which two stars, Norma Shearer and Lew Cody, appeared, the scenes beginning in Miss Shearer's home and flashing from there to the studio. The action begins in the star's home, showing her dancing to radio music, and being reminded by her mother that she is due to appear at the KFI station with Mr. Cody. She calls for Mr. Cody, and they drive to the station together.

The film showed them at the microphones of the KFI station, wherein Miss Shearer pretends fear of the instruments and persuades Mr. Cody to make the first speech.

The picture had been carefully rehearsed and all the accompanying dialogue was broadcast during the filming. No effort was made to present an elaborate play. The only effort was to show that it was possible to synchronize voice with the movement of the player's lips, and the experiment was an indisputable success. The promoters proved their point. With the exception of one or two instances in different houses where operators became nervous the results were remarkably satisfying to all concerned. In one theatre an operator overspeeded the projection machine, with the result that Miss Shearer was still talking when the film had been run through, an incident that brought the audience much amusement.

THE prophecy made by Mr. Hugo Gernsback, editor, in an article in the Sept., 1919, issue of RADIO NEWS, entitled "Grand Opera by Wireless," is of particular interest at this time. Note particularly in this article, which we have reprinted here from our September, 1919, issue, that at that time there was no radio broadcasting; it started several years later. Notice the number of predictions that were made in this early article—all of which have now come true. Even then Mr. Gernsback foresaw that there would be some trouble in paying the artists for broadcasting, although no broadcasting had ever been done, as we now understand the term, at that time.—EDITOR.

Fifteen theatres in Southern California were linked in the experiment, the operators running the projection machines with a hand crank, and wearing head-phones tuned in on the broadcast station, which gave them the metronome time-setting cues for starting the film. The speed of the film was gauged by a metronome before each operator.

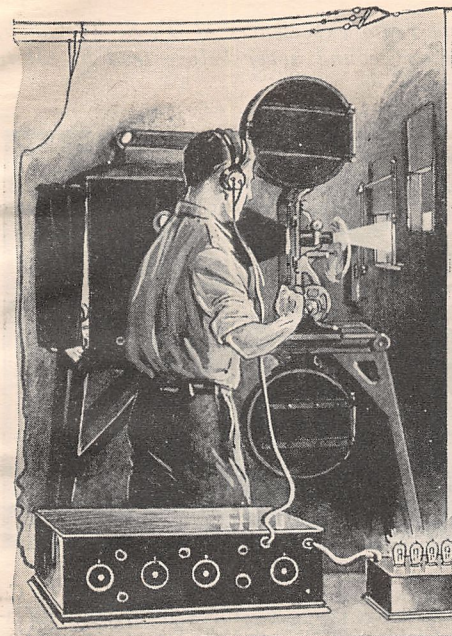
The cues for the actors were run on a special film in the broadcast studio with the picture, the rays being shot through a glass screen, so that they were enabled to time their voices to the movements of their lips on the screen. The glass partition prevented the noise of the projection machine from carrying over the microphone.

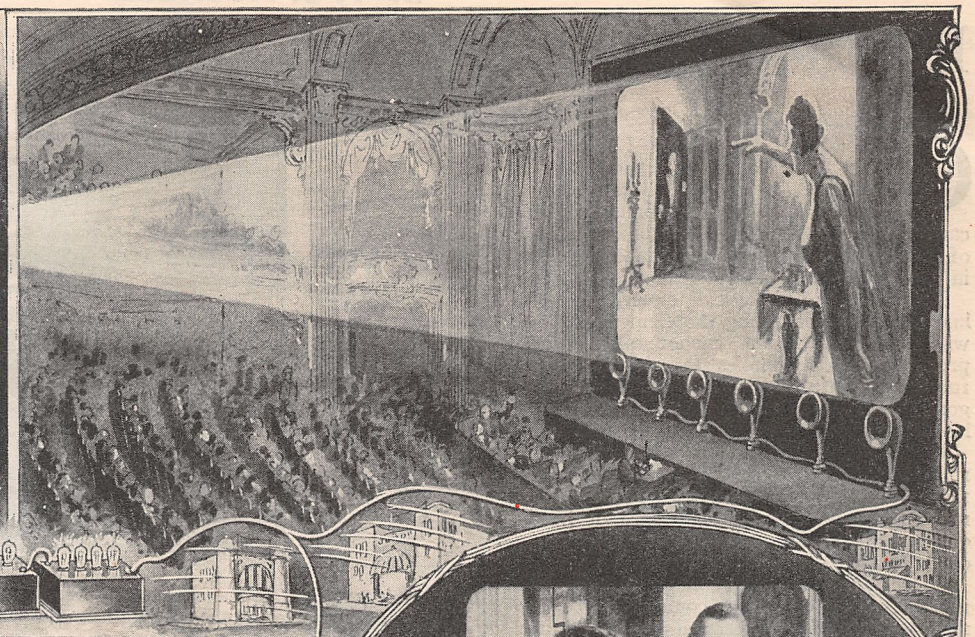
Receiving sets employing power amplifiers were used in the theatres, and in spite of the summer weather exceptional reception was reported in all instances. One feature of the presentation which appealed to all audiences was the absence of distortion and the fact that the voices as broadcast did not sound cramped.

Now that inventors are announcing the control of radio waves, it may be possible soon for a group of theatres to present any length film story to their individual audiences over specially-tuned sets without making the same show available to others who have not paid for the service. The demonstration in Los Angeles has opened the door to conjecture. Preparations are already under way for a repetition of the experiment on a larger scale.

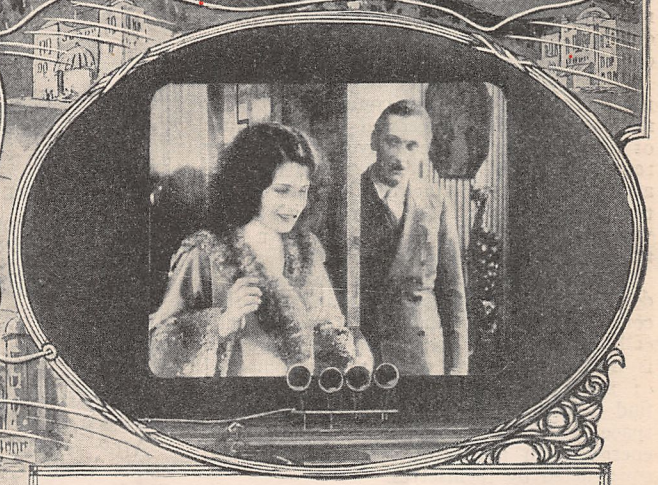
An interesting phase of the radio-motion picture synchronization experiment is the

Are Now Linked



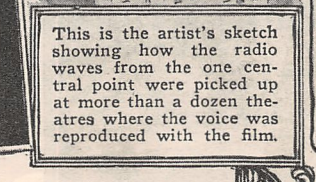


In the pictures and sketches on this page is depicted transmission of movies in synchronism with the voices of the actors taking part in the film, which was carried out in San Francisco with the aid of Station KFI a short time ago. While movies were being shown simultaneously in several theatres, the actors taking part watched a duplicate version of the film and spoke the parts accompanying the action. The words were picked up at the various theatres by radio sets and reproduced through loud speakers.



Above we have one scene of the film showing Lew Cody on the screen and the bank of loud speakers which gave the audience the actor's voice as it originated at KFI.

Above is shown Lew Cody before the microphone in Station KFI, where the voice for the movies was broadcast.



This is the artist's sketch showing how the radio waves from the one central point were picked up at more than a dozen theatres where the voice was reproduced with the film.

Above is a studio shot showing how the film was put on the screen while the actors spoke the parts. While watching their own action, they could keep in synchronism with the action as it appeared in the various theatres.

fact that it represents one of the first attempts at co-operation between motion picture concerns and the radio industry. Radio has had considerable opposition from some of the leading producers, and the introduction of general broadcasting evoked a storm of protest from producers who feared that it would tend to harm the picture industry. One of the biggest concerns on the West Coast prohibited actors under contract from appearing before the microphones of any broadcast station.

But that attitude is disappearing in the face of the realization that radio is something more than a novelty, and has come to stay. It will not keep people from the theatres, and there are great possibilities for co-operation between the two industries. The latest experiment is only a step toward a commercial combination of broadcasting and pictures. Succeeding experiments will go further in demonstrating the practicability of Mr. Gernsback's scientific prediction

(*Continued on page* 740)

Radio with the Rice Amazon Expedition

By T. S. McCALEB

RADIO NEWS is indeed proud to print herewith the first record of the personal and radio experiences of T. S. McCaleb, who kept the Rice Expedition in touch with civilization even while they were on ground never before trod by white men, at the headwaters of the Amazon River.

ONE of the outstanding features of the Hamilton Rice expedition to South America in 1924-25 was the successful radio communication carried on between the two radio stations of the expedition with the various points in the civilized world.

Regardless of practical experience and knowledge of combating the elements of the wilds, an expedition cannot plan every preparation for supplies to maintain them for an estimated period of time to reach a goal, the position of which is merely calculated and the intervening territory unknown.

Many causes that delay progress occur and radio can be used to send a request for additional food supplies and medicines. With radio the party can keep its base or headquarters informed of immediate discoveries, of its progress and of its necessities.

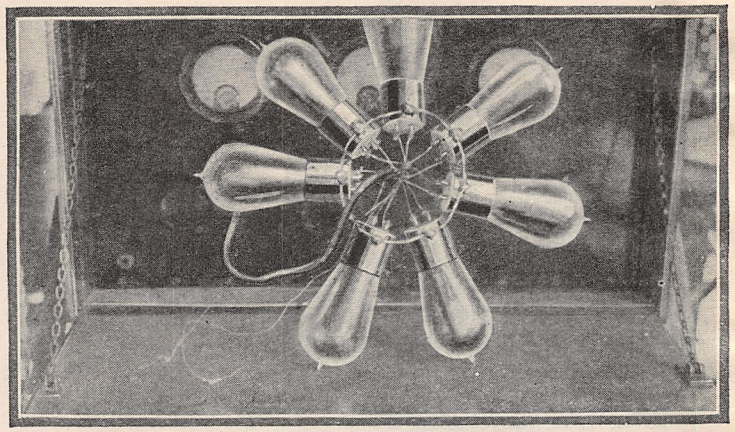
Often while the party may be only 100 miles from civilization communication by mail to keep those interested in the welfare of the members of the party informed may require many months. This news, welcome as it is, is not satisfactory, because of the time which has elapsed. But, with radio, word may be sent and received in a few minutes.

There exists in the United States a wonderful system of reliable communication that connects every city and hamlet with practically any part of the world. This system is maintained by an organization composed of men and boys of all professions, who find a great interest in reaching out into space with a remarkably small amount of energy from apparatus often designed and constructed by themselves.

These amateurs are organized into the American Radio Relay League, which soon will become an international association composed of radio amateurs throughout the world.

It was this organization that kept the Rice Expedition in touch with the world, by heeding its request for assistance when the original scheme of communication with the Brazilian radio station at Manaos failed because of adverse atmospherical conditions and the use of long waves.

To Dr. Manuel S. C. Barros, Districto Radio Telegraphico at Manaos, great credit is due for his untiring efforts, ability and kind co-operation in aiding in the original communication system.



Fifty-watt tubes are scarce in the unexplored regions of the Amazon River at the equator. Here is the method Mr. McCaleb used to make five-watt tubes pinch hit for their larger brothers.

FAILURE OF LONG WAVES

After interruption on the long waves occurred the writer got into communication with 2CVS in New York City, who volunteered to maintain a schedule each night so that communication could be resumed with the outside world. This method was a tremendous time-saver when compared to the earlier process of radio communication from the base station to Manaos, thence to New York via cable.

After several nights of reliable communication with 2CVS in New York, adverse weather conditions caused an interruption and stations 1COT, Braintree, Mass.; 3ATE, Baltimore, Md.; 8ES, Akron, Ohio; 5SK, Fort Worth, Texas, and 2AXF all performed excellent service. Later, a consistent schedule was maintained with Station 2MC at New York, who very efficiently kept a mighty volume of two-way traffic moving.

Other schedules were also maintained with 1ER, Wellsley, Mass.; 1AF, Harvard University; 1YD, Norwich University, Vermont; 8PL, Shawnee, Ohio; 2BR, New York; 5TD and 4JR, Gastonia, N. C., working through 3BZ and 3ADB, Philadelphia; 3CDV and 3BTA, Gladion, Pa., and 3BES, Providence, R. I.

With these stations in the East and stations 6OL, Stamford University, Calif. and 6AWT and 6CHL, San Francisco, in the West, both coasts of North America were directly connected by radio with the expedition.

OTHER STATIONS

Later, 1CMP, 2BY, 1PL, 4GW, 9BW, 8QV, 2AAN, 1SF, 1ARY, 3ADG, 3OQ, 5SD, 2BRB, 9AZP, 2BQU, 2CJJ, 2BQZ and others rendered a great service by accepting messages from persons in the States for the expedition and receiving expedition messages for the United States, not to speak of many times when they stood by for other traffic.

The greatest distance covered was that in exchanging signals and conversation with New Zealand station, 2AP, located at Wellington, at a distance of approximately 8,500 miles from our party. This station was worked on Christmas night and the writer, after bidding Mr. Collier, operator of the New Zealand station, a Merry Christmas, suddenly realized that New Zealand had celebrated the holiday the day before, since it is on the opposite side of the International Date Line.

Mr. Gerald Marcuse of Station 2NM, at Catesham, near London, was the chief English station to connect with the expedition. His station handled several long messages from Dr. Rice to the Royal Geographical Society.

Station 2AG, owned by Mr. S. R. Runyon and located at Yonkers, N. Y., established a record by receiving a message from an individual in New York and telephoning the reply back, which had been received from the expedition in approximately eight minutes from the time the message was filed.

THE PLANE

During a period in the dry season when the water was rapidly falling, the advance party had penetrated a considerable distance. The airplane, with its pilot, Lieut. Walter Hinton, of transatlantic fame, and the aerial photographer, Capt. Stevens, were awaiting word when a flight could be made to meet the party and for vital information concerning landing conditions. Without these reports the plane would have been flown to a spot where the party was encamped and, in landing, might have run into

Though Mr. McCaleb gave the Indians the best in American broadcasting, they were unenthusiastic, for they could appreciate no music more complicated than a tom-tom beat.

rocks below the surface of the water, which would have resulted in a serious mishap. The plane being used was of the scout type with the engine supported above the head of the pilot on a single strut. Any considerable jar would cause the engine to come falling onto the pilot's head, which might be classified at least as unpleasant. As it was the radio link between the advance party and the base kept the pilot well informed of the conditions he would have to meet.

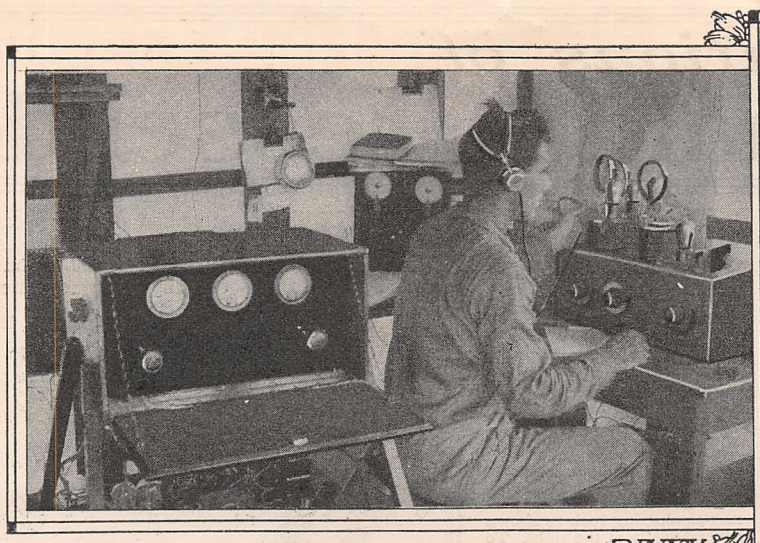
The equipment at the base radio station located at Boa Vista on the Rio Branco (Lat. 2 deg. 49 min. 18 sec. N. Long. 60 deg. 39 min. 55 sec. W. The only way the reader can find this exact spot in an atlas is by the aid of these measurements.) consisted of a transmitter using eight 50-watt tubes to generate a power of 400 watts for communication with Manaos, 400 miles south, on a wave-length of approximately 3,000 meters. A number of photographs of the portable station and some of the apparatus used at WJS and brought up to the portable station by the writer for use in direct communication with the United States after the base had been closed down are shown herewith.

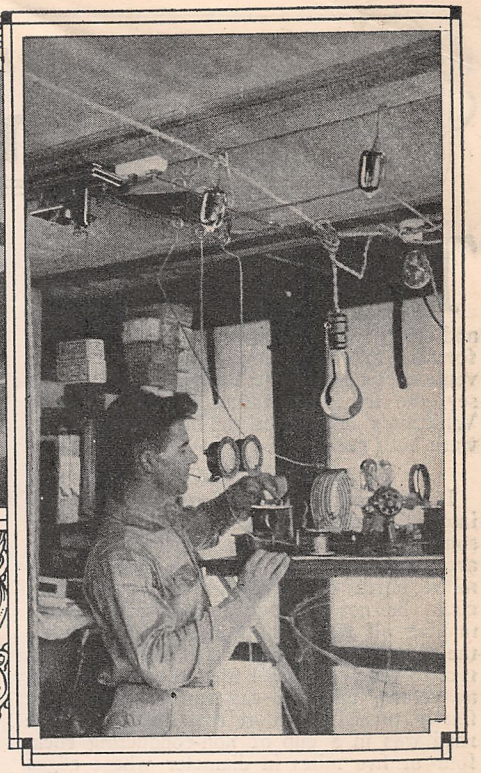
There are several interesting points in connection with the short wave receiver and transmitter which will be interesting to the reader who has never found it necessary, in his radio experience, to deal with the diabolical tropical static.

The transmitter, instead of following the usual plan, is built upon the tuned plate idea. The accompanying hook-up will show at a glance just how the thing was arranged. The inductances—and most of the set, for that matter—were constructed out of parts of the long wave set and spares carried to the base station. One of the photographs, in particular, is interesting. Long before the time set for the return of the party, the large tubes, 50-watters, began to show signs of disintegration. Not wishing to leave things entirely at the hands of chance, the small 5-watt tubes were arranged in series to furnish the necessary power. By soldering them to the circular ring, very good results were obtained. This particular method of mounting kept the effective inductance in each of the tubes the same, so that the maximum output was registered in the antenna meter.

The receiver is novel. A description of the hook-up will show where the deviation from normal occurs. The static conditions were such that the standard hook-up sorely tried the operators by the atmospherics. The stunt described here was then tried. Instead of coupling the antenna and ground directly to the tuning inductance of the radio frequency tube, as is ordinarily done — the complete set consists of one radio detector and one audio — the antenna was connected directly to the plate of the detector and then coupled to the radio frequency tube by the tickler.

An added decrease in static is obtained by using a very low antenna, possibly only 10 or 20 feet above ground, and very short. Both these decrease the signal strength, but at the same time they decrease the static more, resulting in a net advantage.



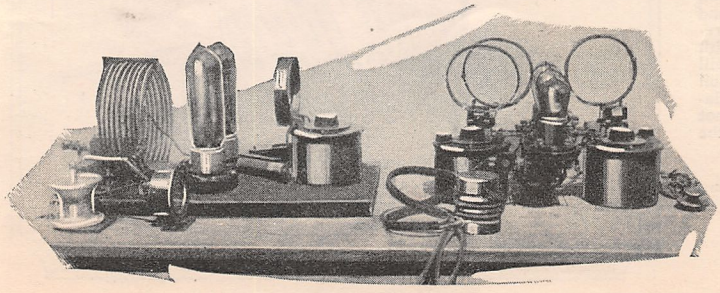


At the base station things were more elaborate. Here are two views of the base station.

THE past year has seen the use of radio in two very important expeditions, viz., the Rice expedition to the headwaters of the Amazon in possibly the wildest region still unexplored, and the MacMillan Arctic expedition. A glance at the accompanying article will give the reader some idea of the advantages radio gives the hardy explorer which he has never enjoyed before. His personal danger is lessened by one hundred per cent. which is no mean consideration in itself, beside the other advantages. But read the article—Editor.

The construction of the receiver and the transmitter are both plain as to mounting and supply. The photographs will describe them thoroughly.

The original gas engine, which was to have been the primary source of power, was a small air-cooled motor-bicycle engine that flew to pieces due to the centrifugal force. An outboard canoe motor was belted to a small generator which furnished power for charging the 12-volt, 80-ampere-hour storage battery. This supplied the dynamotor for the transmitter, which had an approximate power output of 25 watts. John E. Wilshusen, the airplane mechanic, acted as "engineer" when it became necessary to float the generator and battery together for increased power. Upon signal from the operator the engine was shut down for reception. This method was not necessary at all times, since the battery had sufficient charge for one and one-half hours' communication.



The radio apparatus which made the Amazon neighbor to the Bronx. Note the extreme simplicity and lightness of the outfit.

TROPICAL DIFFICULTIES

At the next semi-permanent camp the portable station was again erected in the midst of the thickest jungle. But at this camp, which was a little further north and west, there were hills more than 1,000 feet high that entirely surrounded the camp. During terrific tropical storms no difficulty was experienced in communicating with a number of New England and Eastern Seaboard stations, as well as one Canadian.

An incident worth mentioning took place one night during the transmission of a message from one of the advance camps. The operator, holding the message in his left hand under a small flashlight lamp that was supported in an empty batter tin, turned his head in the direction of the counterpoise lead-in. It was supported on an insulator attached to the improvised table where the apparatus was set up. Seeing nothing, he continued to transmit the message. For no apparent reason he turned his head for a second only, to see a faint outline of a snake lying motionless on the lead-in. The message transmitted, the operator picked up a large-bladed pocket-knife from the table, shut down the dynamo and, holding the knife at the proper angle between his thumb and forefinger, took one quick slash and decapitated the snake, at the same time holding his station for an O.K. of his message. This closed the evening's traffic, as it was the last message on the hook. After examining and photographing the snake, it was found to be a jararaca, a very poisonous type, but it was a small one, only 40 inches long. It was probably attracted to the camp by the hum of the dynamotor.

PHENOMENA

Contrary to results showing a great decrease in received signal strength during daylight, the signal from LR at 10 A. M. on several occasions proved to be approximately equal in strength to the night

(*Continued on page* 747)

The Inventions of Reginald A. Fessenden

PART XI

THE income of our little company, known as the Stanley-Kelly-Chesney Company, was to be derived from three things, from the lighting plant and street railway, the manufacture of transformers, and from developments of new inventions made by the laboratory. Whittlesey, the treasurer, father of "go to hell" Whittlesey, and Hines, the business manager, were both good men.

INSULATING ROCK CUP

In connection with the street railway an interesting thing was noticed which explains some at least of the poor radio reception areas. An extension was made three or four miles north of Pittsfield but no current could be got through the motors. After making all the usual tests without locating the "bug" Chesney connected the motors direct to the feeder and used the trolley wire as return, and the car ran all right. It finally turned out that that section of the road was in a cup of non-conducting rock, four or five miles in diameter whose edges rose to the surface, as shown in Fig. 1. It was necessary to run cables from the rails over the edges and ground them outside.

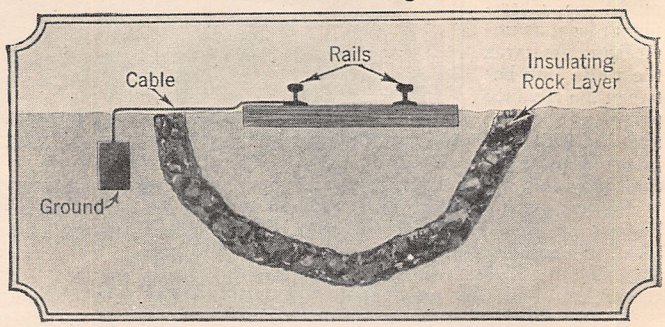


Fig. 1. In the course of Fessenden's traction work, it was found that a section of the road was located in a cup of non-conducting rock as shown schematically at the right. To establish proper ground connection, it was necessary to lead a cable over the edges of the rock layer. The insulating layer was actually four or five miles in diameter.

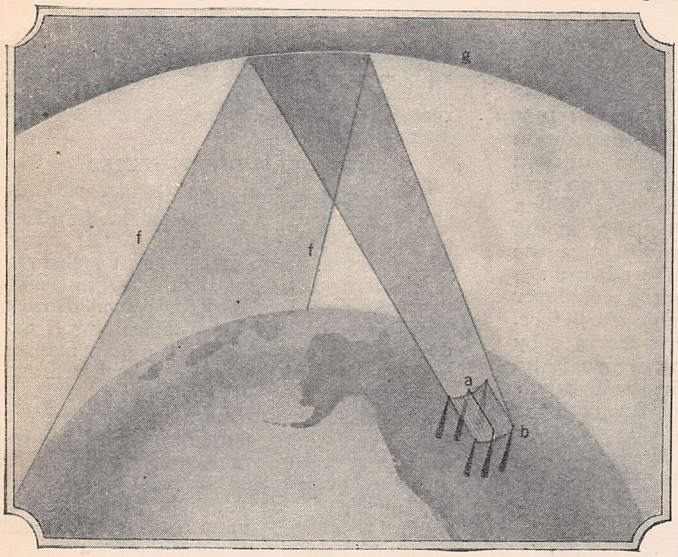


Fig. 2. According to Fessenden, if waves were radiated from a horizontal antenna and reflected up so that the beam reaching the Kennelly-Heaviside layer would be wide and be reflected again from a large area, fading would be considerably reduced. In the illustration, (a) is the antenna, (b) the reflector, (g) the Kennelly-Heaviside layer, and (ff) edges of the reflected beam.

Dr Kennelly later told me of a similar experience he had had with grounding a transatlantic cable, so such cases are probably not rare.

FESSENDEN HORIZONTAL WAVE SYSTEM

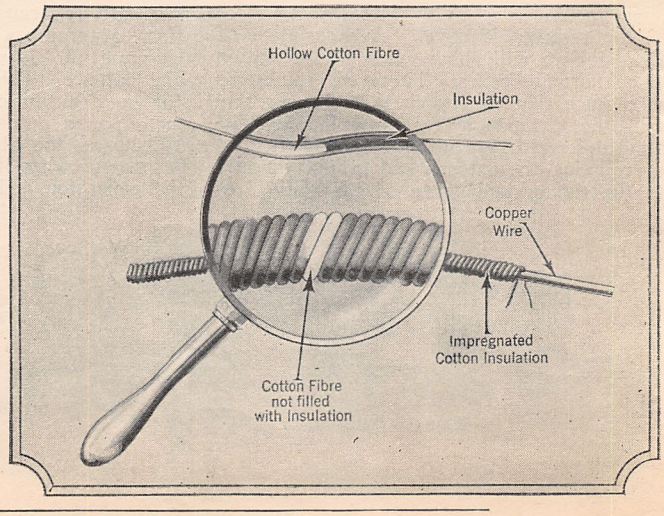
It may be said here that there are good prospects that fading and poor radio reception will be overcome in the near future. Between 1900 and 1906 a good deal of work was done on this and the results published in the *Electrical Review*, London, May 18, 1906. The existence of the Kennelly-Heaviside layer was definitely proved, its height measured and given as 100 miles, and the average size of the "ionephs" or clouds of ionized air forming its lower surface as between ½ to 3 miles, and a curve of the transmission between Scotland and Massachusetts for January, 1906. The fact that transmission was aeolotropic was noted and a relation between the magnetic variation curve and that of the absorption given. Later experiments showed that good results were obtained by using several frequencies simultaneously, and this was published in the *Electrician*, London, December 19, 1919. But about four years ago it was found that by sending out horizontal waves, *i.e.*, waves from an antenna laid horizontally, (see U. S. patents 1,158,124 Oct. 26, 1915, and British pat., 2,995 1908,) so that they would be reflected up and not be absorbed by the ground, as shown in Fig. 2 or combining both exactly as I show them especially if the reflector threw a beam such that when it reached the Kennelly-Heaviside layer it would be wide and reflected from a large area, larger than the ionephs' average size, as shown, there would be little fading. Patent applications for this new "Fessenden Wave" system were filed, and later, in April, 1924, its use was suggested in the General Electric Co., and the Radio Corporation. A brief reference to the system was written to accompany the first of these articles, in November, 1924, and it was planned that formal announcement of the new method should appear in the January 1, 1925, article, but this was accidentally omitted and the method and apparatus will be more fully described later.

TRANSFORMER INSULATION

My first job was to work out a new method of insulating the transformers. Previously shellacked or japanned paper or cloth had been used, but these were hydroscopic and deteriorated with age. The first transformers we made up were insulated with my catalyzed linseed oil and with a flexible varnish made from that and the Zanzibar copal and proved much superior to the old ones as regards burn-outs and could be worked at a higher temperature.

But some years before, I had run across a peculiar kind of asphalt, found only in Utah, and called Uintahite. This was not soft like ordinary asphalt, and did not turn to a thick viscous paste when heated but remained hard almost up to its melting point, which was very high, about 400 degrees Fahrenheit. For these reasons there was no commercial use for it. This was exactly what was wanted for my purpose, for the main difficulty in insulating cotton-wound wire is that the cotton fibres are hollow (as shown in Fig. 3) and unless the insulation is so fluid that it penetrates into these little tubes the ends of some of them, lying on the outside of the covering, will lead in moisture and spoil the insulation, as shown in Fig. 4.

So various percentages of Uintahite were tried with catalyzed linseed oil, and a mixture found which would just not soften at the highest running temperature. Then this was combined with the vacuum boiling method I had been using for condensers, the transformers being boiled in the compound in an old sugar vacuum pan. I well remember my pleasure when after attempting to break down the coils without success, one



Figs. 3 and 4. Cotton fibre is hollow and the insulating oil penetrates this capillary tubing. Fessenden found that this penetration is not always complete and some cotton fibres will remain unimpregnated with the result that they will absorb moisture and spoil the insulation. (The diagrams, of course, are not accurate pictures of the cotton fibre).

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was sawed across with a hack saw and brought me, with the cut surface showing like the section of a submarine cable.

This and the silicon steel for low hysteresis and the condensers were my contributions to the transformer end of the business. But the main part of the success was due to C. C. Chesney. He was an extremely able designer and had worked out some formulae which were very valuable,

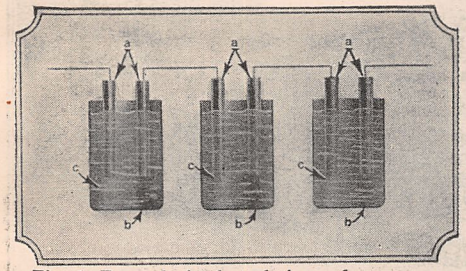


Fig. 5. Fessenden's electrolytic condenser, consisting of sheet iron plates (a), in an electrolyte of bicarbonate of soda (c), contained in iron vessel (b), was similar to the arrangement shown above. The plates of each cell were 1/32 of an inch apart.

one for example that gave the minimum loss to be when the hysteresis losses were equal to the resistance losses. He designed transformers which had only a small fraction of the idle current and all-day loss that the best previous transformers had had, and at lower cost. This and the improved insulation gave the company a splendid reputation and a rapidly increasing business.

HIGH TENSION POWER LINES

Chesney was also the first to see that the new methods of insulation threw open a wide field for long distance transmission at high voltages. He persuaded Stanley to let him try to work at 15,000 volts (1,000 and 2,000 had been the previous standard practice) and installed an experimental line and transformers for that voltage on the Whittlesey estate, which worked perfectly and resulted in fresh contracts.

ALTERNATING CURRENT MOTOR DEVELOPMENT—ELECTROLYTIC CONDENSER

The alternating current motor was not a success. I think now that it would have been, but for the fact that we were trying to develop a commutator type (*i.e.*, one which was really a D.C. motor run on A.C. and with its fields excited by A.C. so that the torque was always in the same direction), to operate at the then standard frequency of 133 cycles. When we came down to 25 or even to 50 cycles, it ran very well. We had low hysteresis silicon steel for our fields, so the field losses were not too high. We got rid of substantially all of the self-induction of the armature by Kelly's compensating winding, which is still used. To eliminate the sparking at the brushes we tried at first vacuum boiler condensers, and when we found that so many were required, on account of the low spark voltage, that the cost was prohibitive, I invented a new type, the electrolytic condenser, consisting of sheet iron plates in bicarbonate of soda, about a thirty-second of an inch apart as shown in Fig. 5 which worked very well and was extremely efficient, showing hardly any rise in temperature after a long run. To get high starting torque, for certain classes of work, we used an enclosed carbon-mercury arc whose property of rectifying had been discovered some years before by, I think, Du Moncel and which might find a use even today, if properly built so that the mercury vapor could not escape. But the standard frequency was 133 cycles and there was no sale for motors to run on 25 or 50 cycles.

When using the electrolytic rectifier I noticed a curious property it had of suddenly losing its ability to act as a capacity and of suddenly regaining it, and that this change could be produced by a spark discharge in the neighborhood. This might be worth investigation as an audio frequency or high frequency amplifier.

ELECTROSTATIC WATTMETER

Another job was the design of an insulation for fine wire for the winding of the measuring instruments for the high tension work. While on this, the number of turns and cost seemed so unnecessarily great that it seemed there should be some other way. Calculation of the electrostatic forces involved, friction of pivots, etc., showed that an electrostatic wattmeter would operate practically, so I built one, shown in Fig. 7, which worked well but has never come into commercial use, possibly because it is more convenient to measure the energy delivered after it has been transformed to the lower working voltage.

The method used for insulating the fine wire, Nos. 32 to 36, was to first clean it thoroughly by passing it through baths of alkali and alcohol; then through a dilute shellac solution, and then through the catalyzed linseed oil and Zanzibar copal and lastly through a long heated drying tube. But the speed had to be slow and some years later the method was superseded by another using a nitrocellulose compound (which, however, was apt to flake off) and still later by the present enamel method, the name of the inventor of which I should like to know as it is an extremely important improvement over the old methods.

MULTIPLEX TELEGRAPHY BY RESONANT CIRCUITS

While with the Westinghouse Company we had installed the electric power plant for the Altoona works of the Pennsylvania Railroad and what might almost be called the usual offer of superintendent of motive power had been received from Dr. Dudley who, with his brother, (connected with the New York Central Railroad) did so much for railway development, and an invitation to deliver a lecture at Altoona before the Pennsylvania Railroad engineers. The subject they chose was the design of telegraphic apparatus but as delivered covered a wider field. It was later published in the Journal of the Franklin Institute, "Electromagnetic Mechanism, with Special Reference to High Speed Telegraphy," June, 1900, and contains a number of formulae which should be of interest to those engaged in this line. After the lecture Dr. Dudley and others brought up a difficulty they had been having on their railroad telegraph lines, due to the large number of stations in series, and asked if it could be solved.

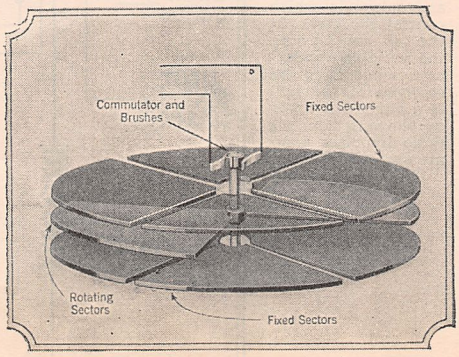


Fig. 6. In working on measuring instruments for high tension currents, Fessenden invented the electrostatic watt meter. It could indicate power directly in the high tension circuit.

Of course most of the work on the A.C. motor development at the laboratory had been done with resonant circuits and it occurred to me that by working the line multiplex with different frequencies and tuned circuits the difficulty could be overcome. Dr. Dudley approved and I took some of the instruments back with me to Pittsfield and made some tests which were successful, but Stanley very rightly decided that there would be no money in that line of work. So I took the system to an old friend of mine, in the transatlantic cable business, Mr. C. Cutriss, who had himself made some improvements in cable apparatus. He gave me a very courteous hearing, while I explained my method of working cables multiplex by low frequency tuned A. C. signals, and then said, "Mr. Fessenden, I think your system would work. But we do not want it. Every one of our cables has cost us $3,000,000 and we have to earn dividends on them and the greater part of the day they are hardly worked at all. But if you can invent something which will prevent all cables from sending more than four words a minute, we will give you a million for it." Of course, he was not quite serious, but I saw his point, that high speeds of working were not wanted, and dropped the matter for some years, until 1914, when it was proposed again but turned down.

INCANDESCENT LAMP FILAMENTS WITH WELSBACH COATING

Most of the time was spent on making up incandescent lamps with filaments coated with the mixture of thorium and cerium which Welsbach has invented for incandescent gas mantles. Stanley had the idea that if this were used as a filament coating the lamps would give much more light and my efforts to prove to him that the effect was a catalytic one as shown by the effect of the small percentage of cerium, were ineffectual. Of course, I did my very best to make the idea work, but equally of course without result.

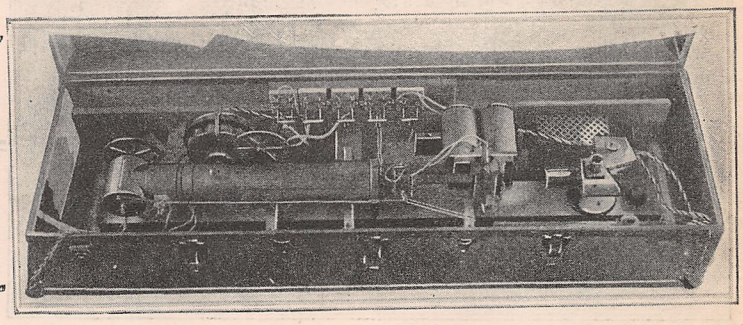


Fig. 7. The filament or string galvanometer invented by Fessenden. Instead of a moving coil, this galvanometer makes use of a vibrating gold wire. The galvanometer is capable of recording frequencies up to 50,000 per second.

VISIT TO ENGLAND RE HIGH POTENTIAL TRANSMISSION

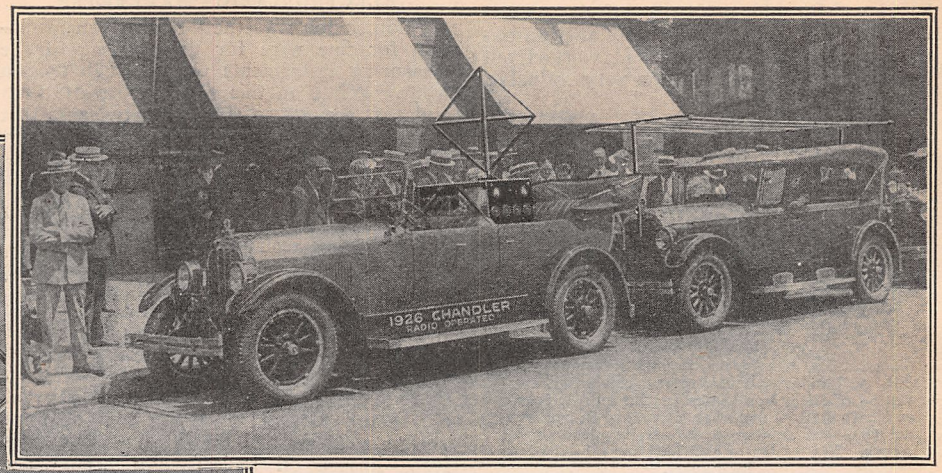
When it was clear that the Welsbach coating would not operate, and the transformer work was completed, Stanley wished me to go to England to see what was being done there in high potential transmission work, especially by Ferranti. Ferranti was one of those engineering geniuses who appear every now and then, but too much in advance of their age. Like Brunel for example. He had seen that the right way to light cities was from a large central station outside of the city and had built a large station at Depford and designed and built great dynamos and was sending the current into London on concentric 10,000-volt mains. Looking it over it did not seem adapted to conditions in the U. S. at that time, and I so reported to Stanley, adding that I was going to investigate the new

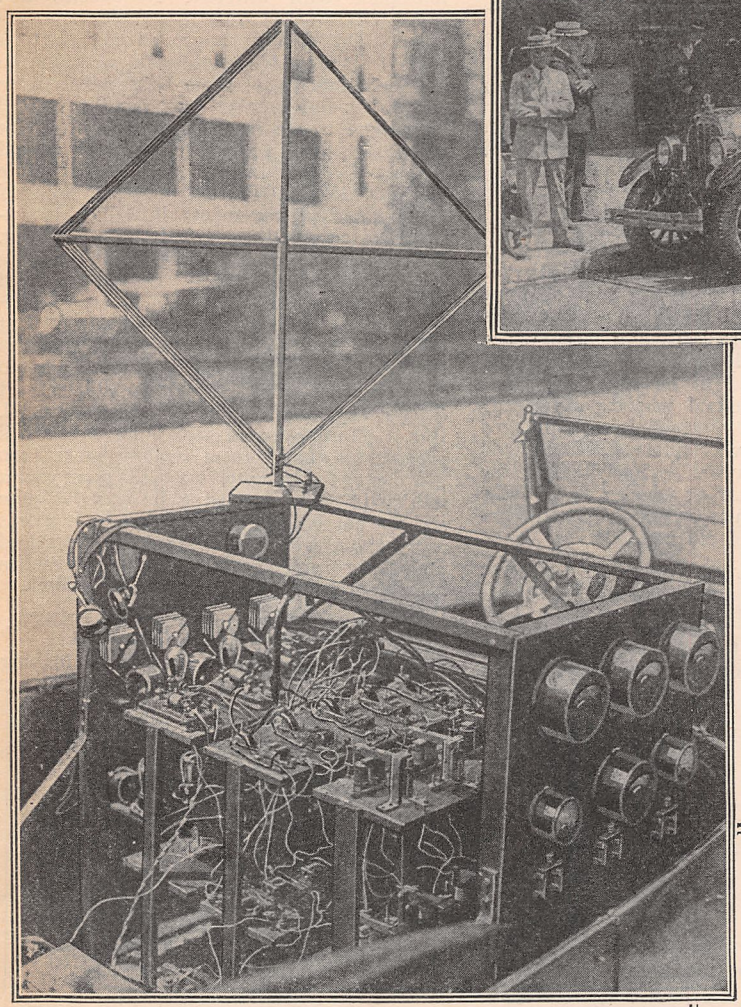
(*Continued on page* 712)

Radio-Controlled Automobile

By HERNDON GREEN

Radio is to control a car in transcontinental tour. The system, which is extremely simple and effective, is fully described here.





Above is shown the two cars used in the transcontinental tour by Mr. Francis P. Houdina. The front car has no driver but is controlled by radio from the second car. Note the transmitting antenna and the receiving loop.

SOME weeks ago the daily press heralded the first accident which befell an automobile proceeding on its way up Fifth Avenue, New York. The car was a strange affair. In the tonneau was the most complicated collection of radio sets, relays, circuit-breakers and other electrical apparatus, one can imagine. Closely following the first car was a second one containing two radio transmitters and an operator. When the keys were pressed in the second car, the first one changed its course, blew its horn or blinked its lights. In short, the second car was controlling the one in front by means of radio.

The mechanical and electrical end of the apparatus is simple in the extreme. There are two transmitters and two receivers. One operates on 178 meters and the other on 103 meters. The longer wave transmitter actuates the selector switch, which picks one circuit of the many and closes it for operation. However, the battery current is not connected to the particular controlling device until a dot is sent out on the second transmitter. This puts into operation the exact circuit selected by the first transmitter. Thus, if it is desired to throw out the clutch, the selector switch is first moved to the point which will select the circuit attached to the clutch motor, and when the action is desired, the second key is depressed, closing the battery circuit, operating the motor and so throwing out the clutch.

Above is the receiving loop and the relay devices which operate the motors and solenoids which control the car. At the left can be seen the variable condensers which tune the receiver. At the right is a simplified hook-up showing how the radio impulses operate the various agencies of the car.

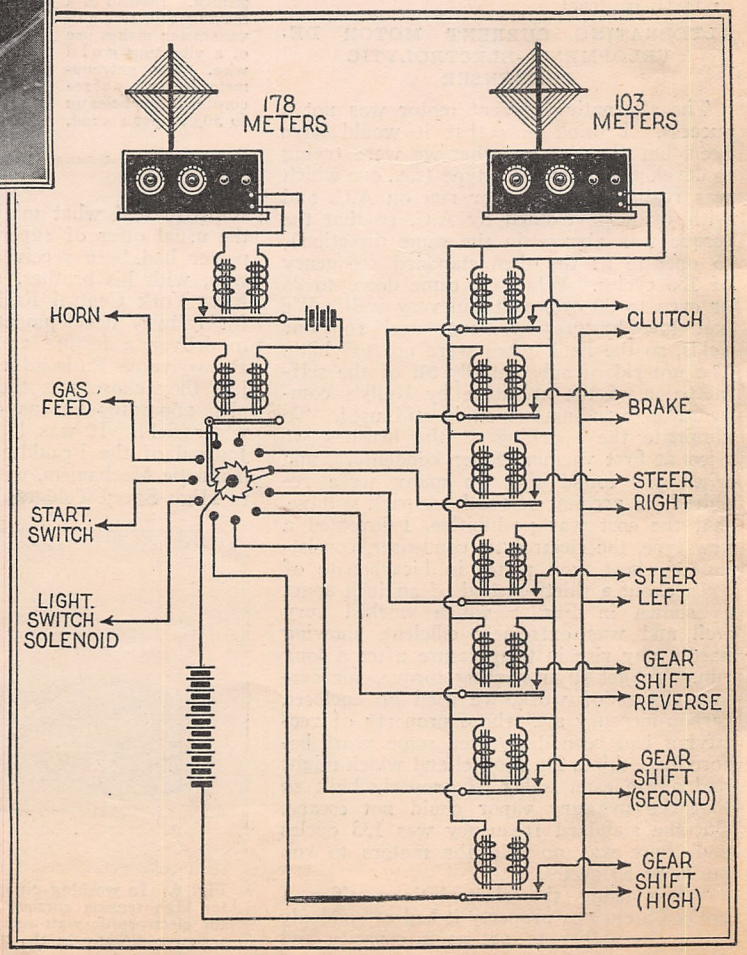
THE DIAGRAM

A glance at the wiring diagram given in an accompanying illustration will show the circuit in its simplest form. Some of the amplifying relays are left out in order to simplify the circuits.

The two transmitters are of the usual 10-watt type, using storage battery supply for the filaments and plates. They are housed in the tonneau of the control car together with the power units. The keys controlling them are placed on a small shelf at the right side of the dash.

The receivers are the usual type, employing loop and radio frequency with two audio stages. Since it will seldom be necessary to work over a distance of more than several hundred feet, the receivers do not need

(*Continued on page 656*)



Can You Find the 34 Mistakes on Our Cover?

As you locate the mistakes, run an arrow from the encircled figures to each mistake. Use method as shown at "No. 27". Note that placing the binding posts on front of cabinet is not a mistake. This is intentional. Don't try to find mistakes from this picture. *Work from the Cover.*

NOW that everyone is following the craze, and buying radio sets right and left, it has been the policy of RADIO NEWS for some time to give as much information about sets as possible. This is particularly for those persons who have never used sets before. Every year a new crop of set users comes along, and they must, as a matter of course, learn how to use their sets.

So, when the time came around for this month's RADIO NEWS cover, we told Mr. Howard Brown, our well-known artist, that we wanted a painting of a standard 3-dial tuned radio frequency set, such as is now so popular. This picture was to be the front cover and was to show all the connections of the set, so that everyone could see how the set was hooked up. But we had not figured on the vacation period. The order was given rather late to the artist and he took down our notes and promised he would do his usual fine job—and we daresay he did! He did it up "Brown." He showed us the customary preliminary pencil sketch, which looked fine, and so we gave him a direction sheet on which we indicated the connections and all the usual details.

Within a week the cover was duly delivered by messenger, with a note from the artist saying that he had left on his vacation the evening before and hoped the painting was to our liking. We looked it over, and it certainly did look good to us. However, on closer inspection, we had the surprise of our lives, and the more closely we inspected the picture the more astonished and amazed we became. Evidently Mr. Brown had been in a terrific hurry when he painted the cover, because by the time we recovered from our shock *we found that he had made no less than 34 mistakes in the picture*—unbelievable as this may seem at first inspection.

But it had come so late that we found

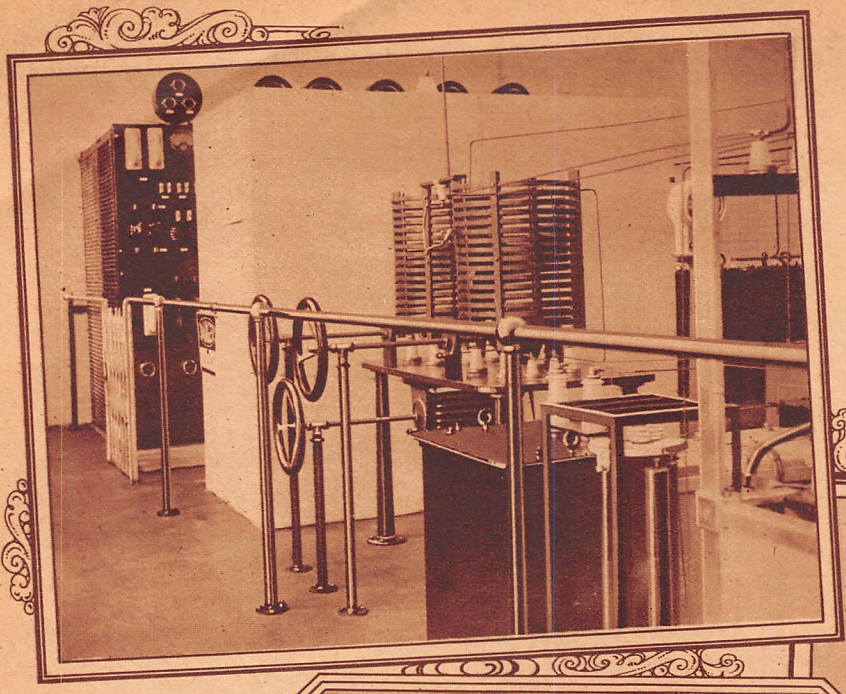
(*Continued on page* 654)

$300 Prize Contest

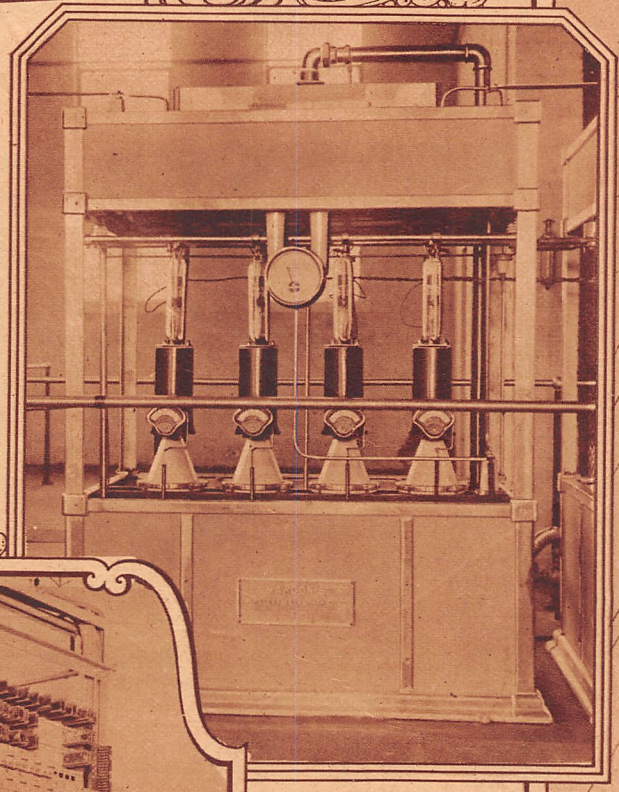
Cash Prizes

First Prize	$100.00
Second "	75.00
Third "	50.00
Fourth "	25.00
Fifth "	10.00
Sixth to 13th Prizes, each $5.00	40.00
Total	$300.00

England's New Broadcast Station, 5XX

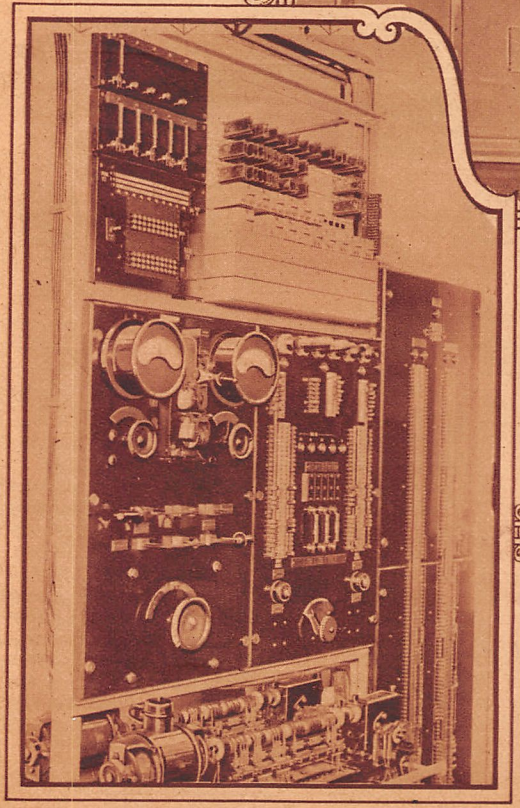


TRANSMITTING ROOM. Here are shown the high frequency inductance, the condenser case and the output transformer. The station has a rated power of 25 KW.

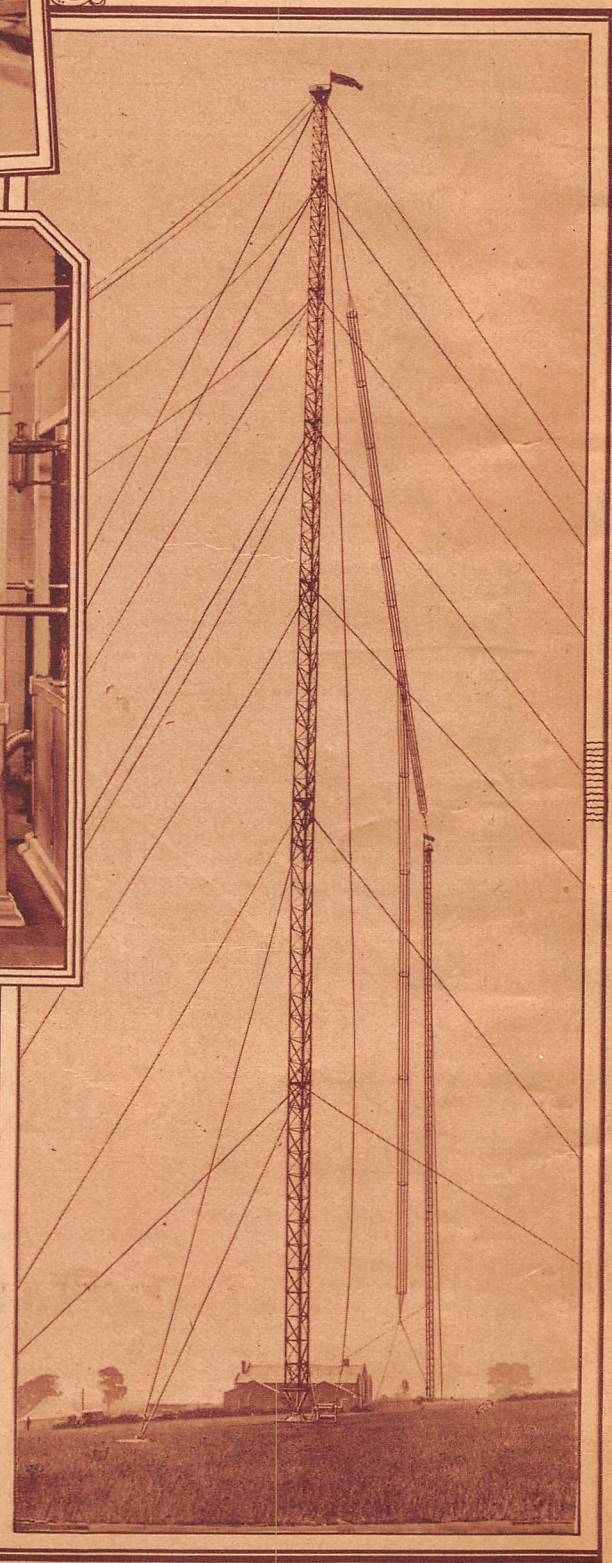


THE MODULATOR "VALVES." The four large vacuum tubes are used for speech modulation and the heat generated in their operation is so great that it is necessary to have a water cooling system to keep the tube elements at a safe temperature. The water pipe can be seen on the right hand side of the cabinet and at the top.

Photos on this page by United.

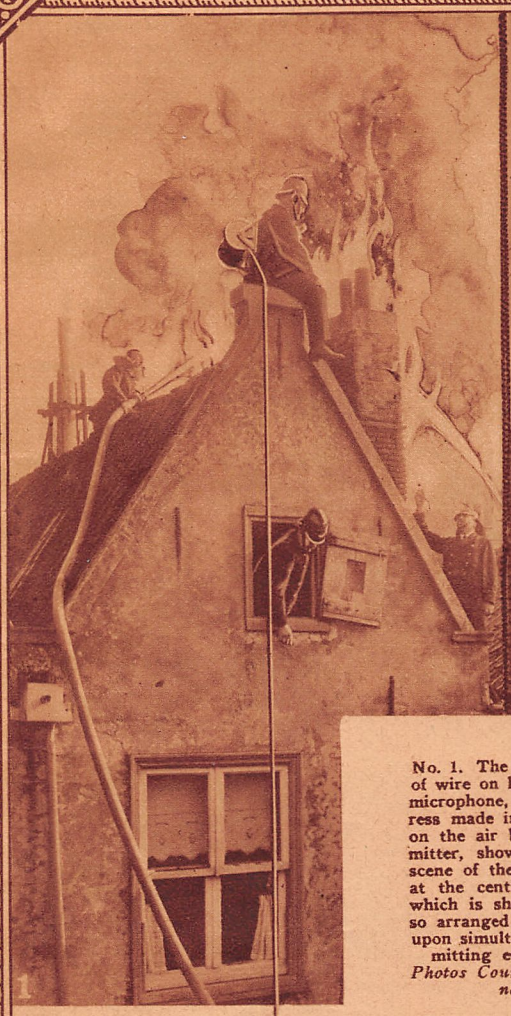


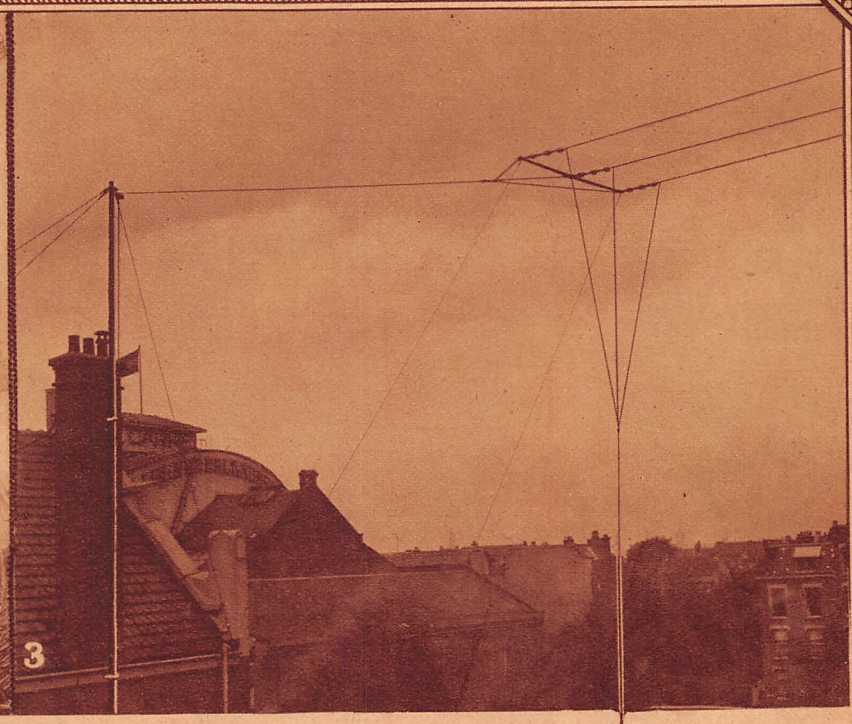
THE DISTRIBUTING POWER BOARD. One of the most important units of the broadcast station is the power distribution panel, where different combinations of oscillator and modulator tubes can be made.



GENERAL VIEW OF STATION 5XX. This station is 650 feet above sea level, being located at Chelmsford, and when operating at maximum power will reach over twenty million people, as the site was chosen as near the center of population of England as possible. The wave-length of 5XX is 1,600 meters.

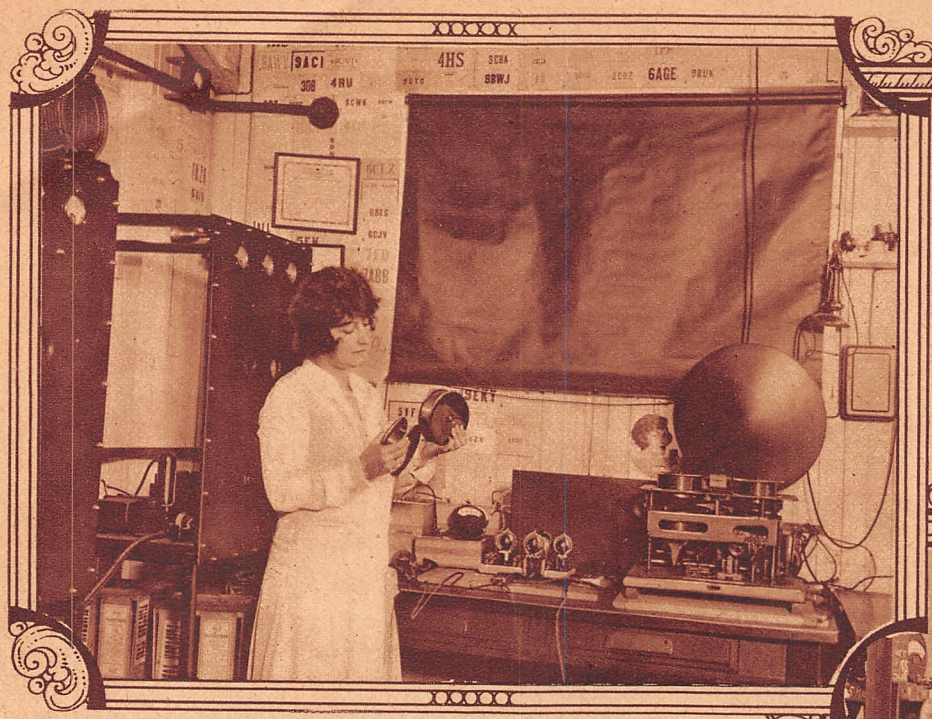
Radio Used As Fire Fighter





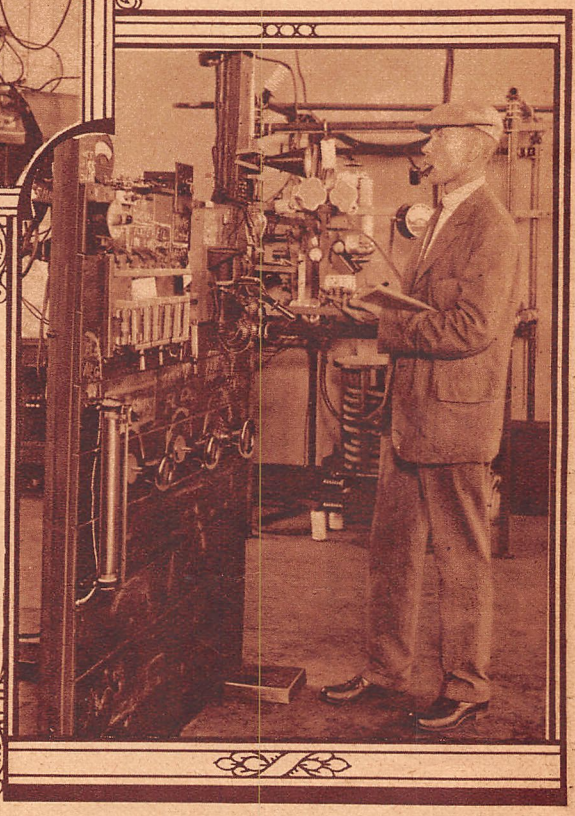
No. 1. The fireman on the roof carries a reel of wire on his back to which is connected a microphone, into which he reports the progress made in the fire-fighting. This is put on the air by means of the portable transmitter, shown at No. 2, which is at the scene of the fire. The message is received at the central fire station, the antenna of which is shown at No. 3. The system is so arranged that three fires can be reported upon simultaneously. The receiver and transmitting equipment is shown in No. 4.
Photos Courtesy of "Fire and Water Engineering," (New York.)

The Fire Department of Amsterdam, Holland, has adapted radio, not only for signaling the central station when a fire occurs, but also to keep headquarters informed as to the progress made in fighting the conflagration. The transmitting and receiving equipment is housed in a truck with a special body, which is driven to all important fires so that the central station can be in direct communication with the fire fighters constantly. Each of these trucks is supplied with maps of the city, drawn to a scale of 1-1,000. These maps are 9½ by 7 inches and indicate hydrants, wells, hazardous structures and other pertinent information.

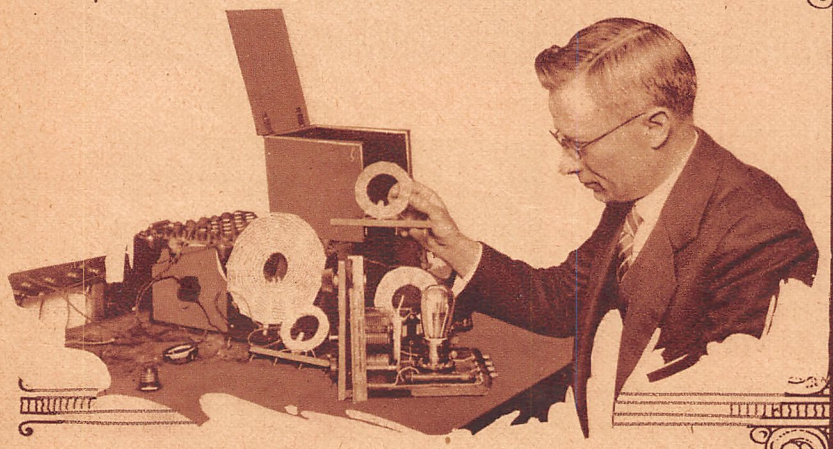


RECORDING VOICES ON ELECTRICALLY CHARGED WIRES. The method of recording on wires was discovered a quarter of a century ago by Valdemar Poulsen, a Danish inventor, but the system was impractical until the vacuum tubes could be used for amplifying signals. © International Newsreel.

DAILY TIME FOR ARCTIC EXPEDITION. Dr. A. H. Taylor, superintendent of the U. S. Naval Research Laboratory at Bellevue, D. C., is taking readings from the 4200-kilocycle transmitter used for broadcasting time signals to the MacMillan Arctic Expedition. © P, and A.

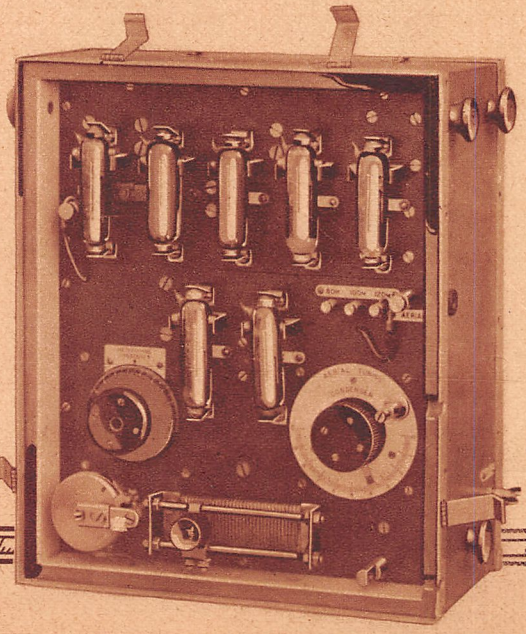


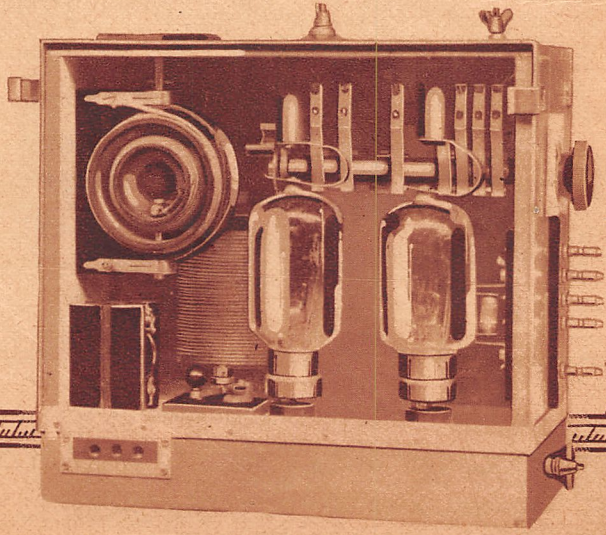
PORTABLE TRANSMITTER AND RECEIVER. The Lighthouse Service of the Department of Commerce developed the set shown below. © Harris & Ewing.

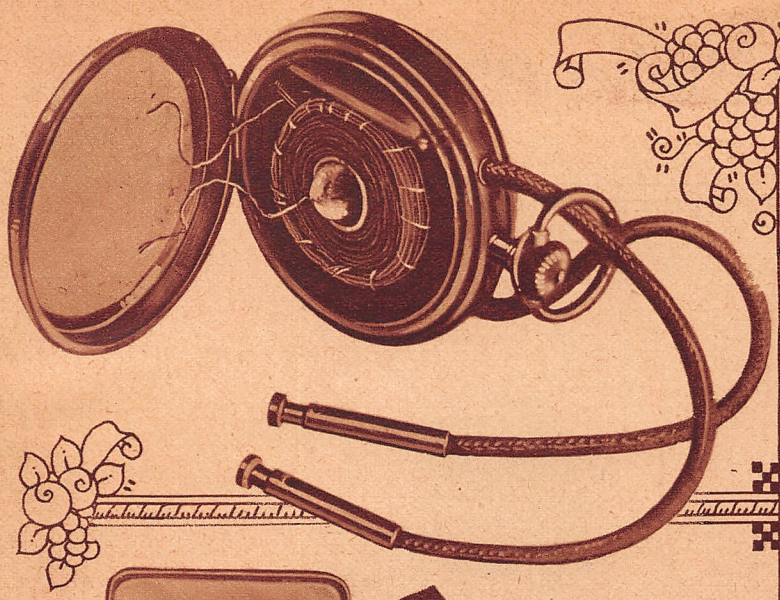


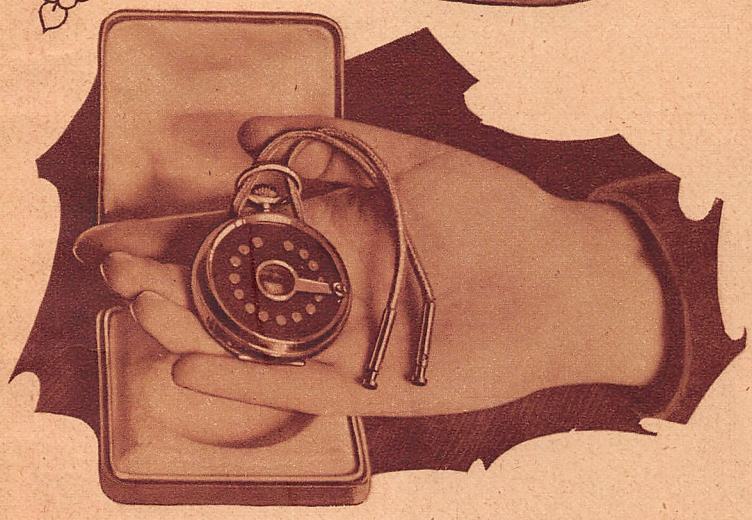
ENGLISH AIRPLANE RECEIVER. The wave-length range of the new Marconi receiver is from 75 to 140 meters. A fixed antenna is fitted around the fuselage of the plane, eliminating the trailing antenna. © Kadel & Herbert.

NEW MARCONI TRANSMITTER. The two units, shown below and on the left, are to be used for communication between airplanes while in flight. The complete equipment weighs only 67 pounds. © Kadel & Herbert.

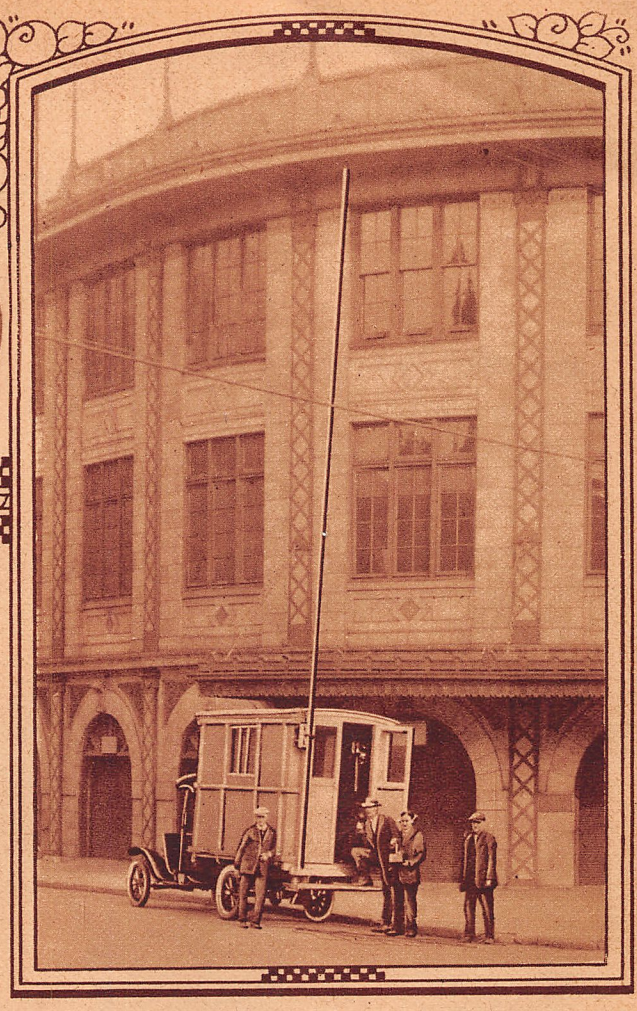






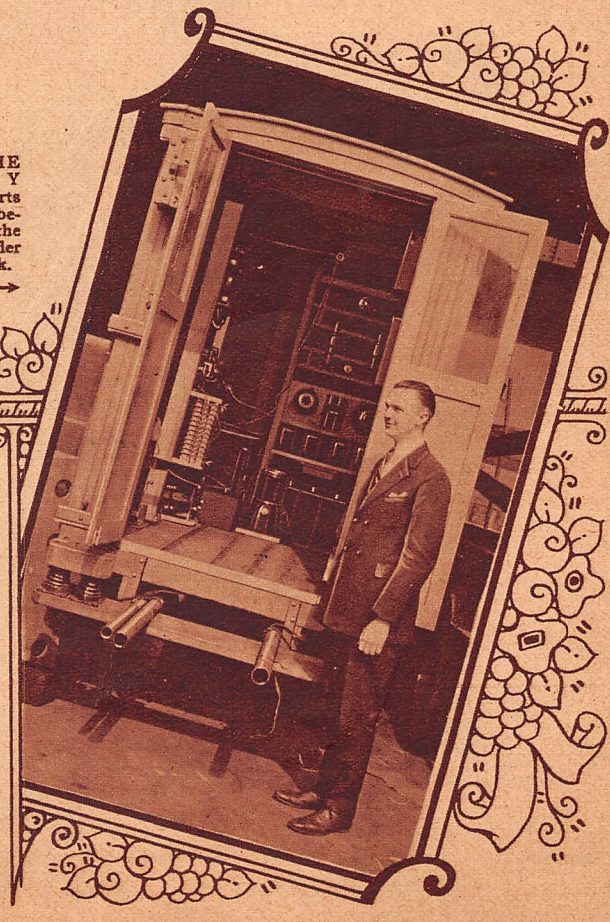


WATCH-CASE CRYSTAL RECEIVER. One of the unique sets that was entered in the Radio News Home-Built Set Contest is shown above. The wires shown are the antenna and ground leads, a condenser is in the cover of the case and the taps of the coil are brought out on the face of the watch. The phone tips fit into small jacks at the bottom of the case.



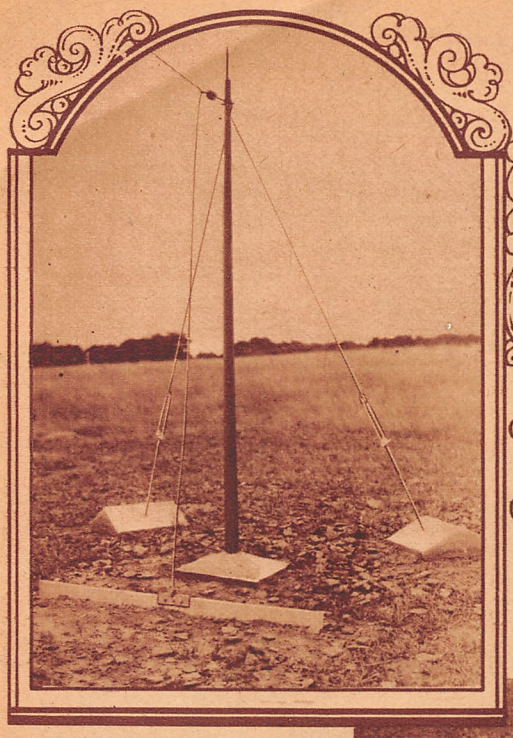
A COLLAPSIBLE ANTENNA. The antenna of the portable relay station used by KDKA as a pick-up station. The antenna is a collapsible jointed copper rod of the vertical oscillator type and is shown in the above photograph attached to the truck that houses the station.

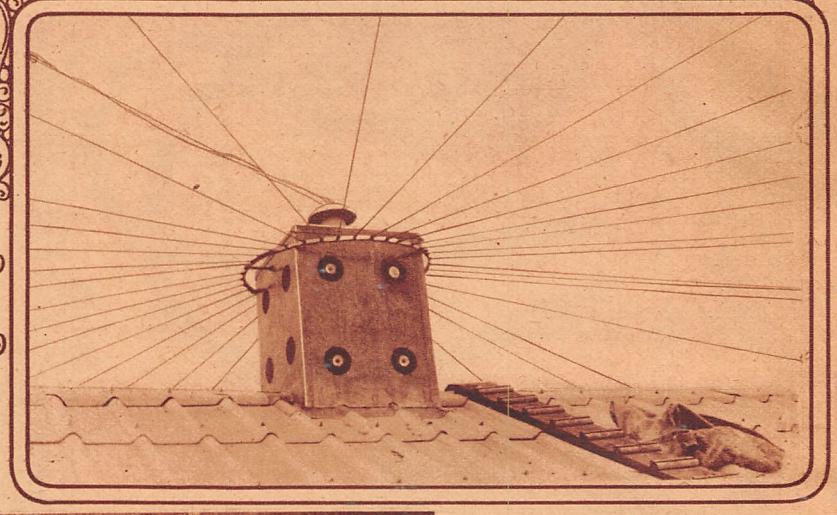
REAR VIEW OF THE KDKA RELAY TRUCK. The supports for the antenna are behind the left door and the antenna is slung under the floor of the truck.



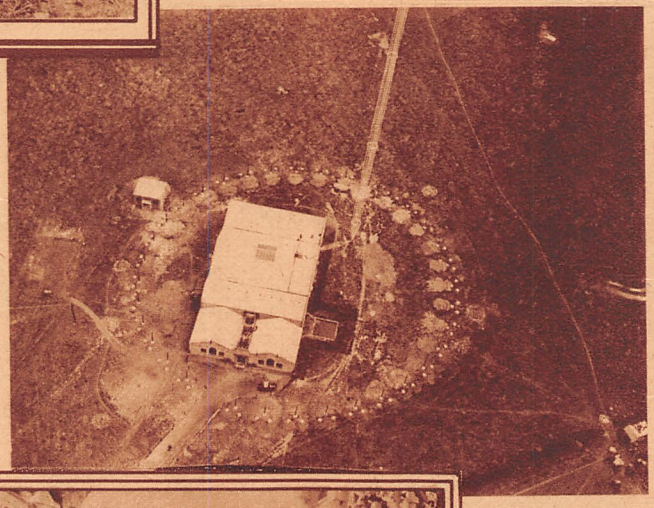
INTERIOR OF THE KDKA TRUCK. The transmitter is a quarter KW. set, the power being obtained from a 110-volt lighting circuit and stepped up to 2000 volts D.C. The transmitter, which operates on a wavelength of 35 meters, has relayed programs 20 miles from the station.

Radio Abroad





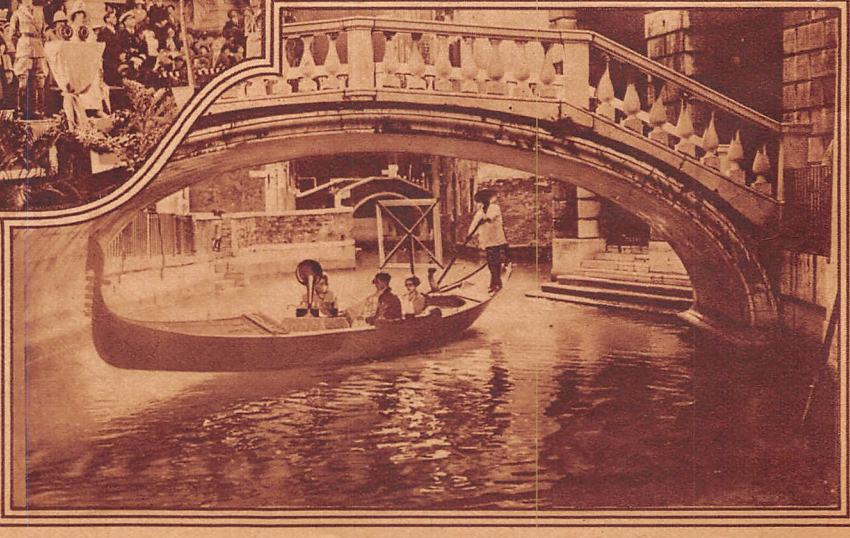
THE LEAD-IN TRUNK ON TOP OF THE STATION. The ring surrounding the trunk is the terminal of the ground plates. This system of counterpoise is considered one of the best known.



ONE OF THE GROUND PLATES OF STATION 5XX. The newest of England's broadcast stations has a unique ground. Surrounding the station are plates, buried as shown in the photograph above. The wire connecting them to the transmitter is carried from the plate to the insulator on top of the 15-foot pole.

BIRD'S EYE VIEW OF 5XX. This photograph, taken from the top of one of the 500-foot antenna masts, shows clearly the ring of thirty-five ground plates surrounding the station. The lead-in from the antenna may be seen in the middle of the picture.

RADIO USED TO BROADCAST WELCOME TO THE PRINCE OF WALES. During the travels of His Royal Highness radio played an important role. At Durban the speech of welcome of the Mayor to the Prince was put on the air. The latter may be seen just to the left of the microphones.



RADIO ON THE GRAND CANAL IN VENICE. Radio has invaded the canals of this city and gondolas are being equipped with receivers as an added inducement to tourists. The gondola on the right is one of the first to be so equipped. © International Newsreel.

WRNY Starts Broadcasting Innovation

By CHARLES D. ISAACSON
Program Director WRNY

Above: Dr. Chas. D. Isaacson.

On Monday evenings at 8:30 P. M. you will hear all about famous artists as told by Mlle. Dugas.

Mlle. Celeanor Dugas.

The literary, theatrical and fiction departments of WRNY will be directed by Miss Browne.

Miss Anita Browne.

The music of the world will be presented via radio by Mr. Cooper and the Volga Trio.

J. van Cleft Cooper.

Miss Lee, known as "The Love Song Girl," will undoubtedly be one of WRNY's most popular singers.

Miss Lorna Lee.

(Editorial Note: *The new Program Director is known all over the world as organizer of concerts for the masses, having reached more than* 5,000,000 *people face to face—as lecturer, author and newspaper man.*)

IT is going to be the greatest fun of all the things I have ever tried to do, working out this new plan of broadcasting.

Yesterday, you might say, I went for the first time to an improved microphone and could scarcely believe myself as to what was happening. Yesterday, you might say, when I first told my friends that a man only thirty miles away had heard me, they said to me: "Dream on, dream on."

First, there is broadcasting, and then there must come system in broadcasting. To me radio is a combination of theatre, concert hall, opera house, unversity, town hall and field of sport. Eventually there is no question but that certain stations will be known for certain things, just as magazines are known in certain fields.

But, in the meantime, it will be the plan of WRNY to get away from the haphazardness of broadcasting and so to organize our time on the air that our listeners will know now, and tomorrow and months to come, what they will find by tuning in on WRNY at any moment.

In order to do this, WRNY has divided its program into music, the other arts, the theatre, literature and other educational subjects. These departments have been subdivided so that in music we find grand opera, light opera, oratory, song literature, chamber music, violin courses, etc., and, of course, the best of the popular music.

In literature, we have fiction, poetry and serious writings, old and new.

There is a sculpture department, courses in history, geography and science, and so on. The plans will work out something like this: If you tune in on WRNY Monday, you will always find popular dance music, folk songs and national music of the world. Always on Monday there will be poetry and painting and history and geography and travel, but Tuesday, on the other hand, will be a night for light opera and orchestral concerts, and just a word or so on architecture.

If you are of a studious turn of mind, you will soon learn that always on Tuesday you can find lectures on law and history—and so it will go on all through the week. Wednesday will be dedicated to songs, fiction, history and sculpture, and Thursday, the more popular music with certain concert features.

Friday will always be known as grand opera and band concert night, and the night of unusual novelties. I do not want to tell the whole story here. Radio News has already published a little booklet that gives a plan and outline, which will be mailed to you upon request. The staff of WRNY is now at work on a big broadcast book that you will want to have in your possession, because it will be the first advance prospectus of broadcasting of any station in history. It will tell you at least six months in advance how to follow everything you want to know.

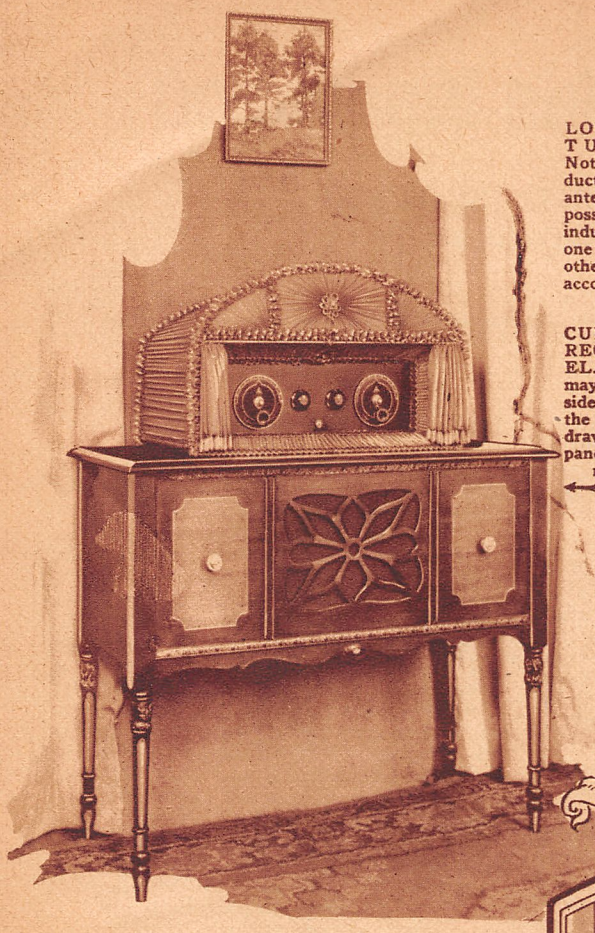
In order to carry out this tremendously ambitious program, WRNY is gathering about itself an excellent company.

In the grand opera department there will be associated regularly such noted conductors as Clementi De Macchi, Salvatore Avitabile, Louis Aschenfelder, E. D. d'Avigneau. Both Mr. De Macchi and Mr. Avitabile have conducted throughout Europe and America and Mr. Aschenfelder has turned out some of the greatest singers. D'Avigneau conducted the California grand opera company and brought Leoncavallo, the composer of "Pagliacci," to America. One organization that is now being prepared for WRNY is a complete chorus and orchestra.

The light opera department will give such performances as "Patience," "The Mikado," "Tales of Hoffman," etc. An organization

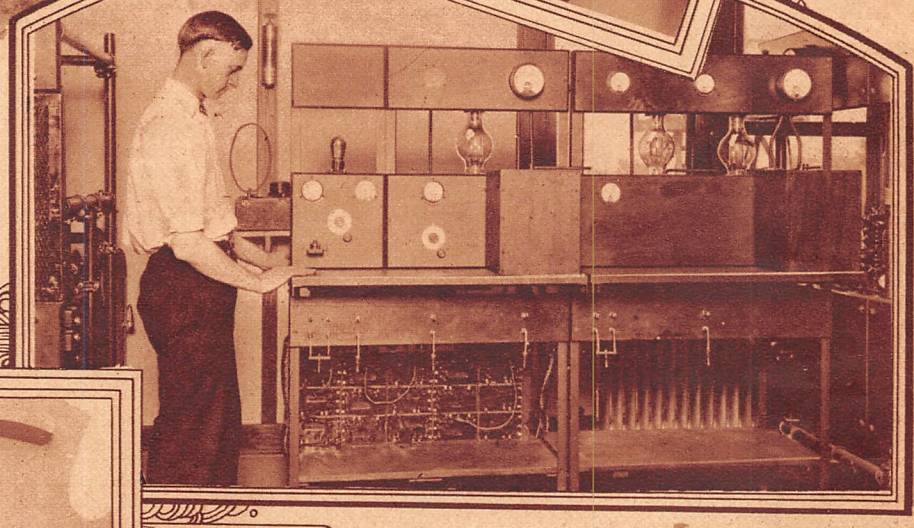
(*Continued on page* 735)

Alexandre Zeitlin will broadcast a series of talks on sculpture Tuesdays at 8:30 P. M.



LOOP THAT IS TUNING UNIT. Not only does the inductance serve as an antenna, but as it is possible to vary the inductance by sliding one loop past the other, the tuning is accomplished. © Kadel & Herbert.

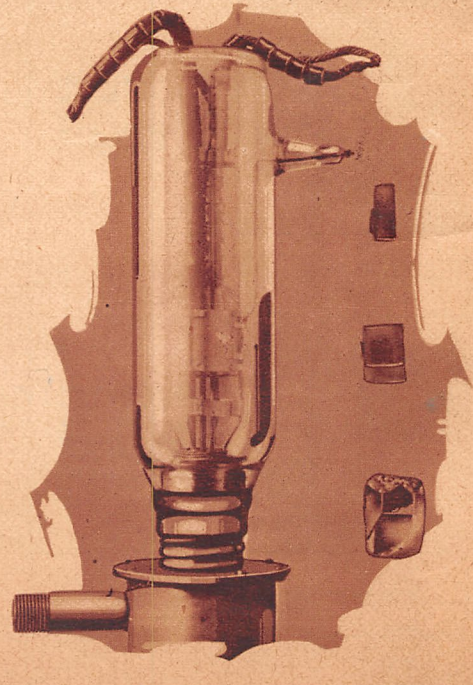
CURTAIN HIDES RECEIVER PANEL. The curtain that may be seen on each side of the panel of the receiver can be drawn in front of the panel, when the set is not being used.



CRYSTAL SOLVES INTERFERENCE PROBLEM. The installation of a piezo-electric crystal in the transmitting circuit keeps the transmitter exactly on the desired wave-length, eliminating any possible interference with other stations. The crystal is shown over the man's right hand.

NOVEL LEAD-IN ON SHIPBOARD. To bring the lead-in through top of the window would prevent its being closed, so the operator fastened the wire to each side of the handle that is used to raise the glass and so successfully solved the problem. © Kadel & Herbert.

QUARTZ CRYSTAL USED IN BROADCASTING. Although the ten K.W. tube shown is large in comparison with the piezo crystal, the latter is responsible for the tube keeping within its proper limits. © Kadel & Herbert.



Plastic Radio by the Kluth System

By DR. ALFRED GRADENWITZ*

Another method for producing stereophonic effects in radio reception is interestingly described below. The effect is produced at the receiving, instead of the transmitting station.

In the October issue of RADIO NEWS an article submitted by Ludwig Kapeller entitled "Radio Stereophony" described the method of obtaining stereophonic or binaural reception of electrically conducted sounds, which has been put into actual use in Berlin. The method described employs two separate microphones, two separate radio transmitters and receivers, and two independent telephone receivers. This is an expensive method at best, but the system described in this article is worthy of a trial by our readers, as it can be reproduced at relatively low cost.

The stereophonic effect is accomplished, not at the transmitting end, as in the previous method, but at the receiving end, where a certain difference in phase between the currents in the two telephones is caused, to produce the binaural effect. This is done in a simple manner by means of a special variometer of very high inductance.

—Editor.

OUR readers have possibly wondered why even the most perfect broadcasting of music fails to convey an enjoyment comparable to that of direct listening. Is it possibly because our most important sense organ, the eye, is excluded from co-operation, or is it due to slight defects inseparable from even the best reproduction? The true cause has lately been found to be a defect similar to that of one-eyed vision.

A conception of space, in fact, is known to be due mainly to the co-operation of the two eyes, each of which, on account of their not inconsiderable distance, receives a slightly different visual picture of its surroundings. That even our sense of hearing is connected with conceptions of space has so far been mostly left out of account, though the mutual distance of the two ears, which is about 8¼ inches, is bound to bring a sound coming from the left, for instance, a little later to the right than to the left ear, so that the acoustic perceptions corresponding to the two ears, in spite of our remaining unconscious of the slight difference in time, are bound to differ from one another. Just as our sense of vision fuses the left and right eye impressions into a single plastic picture, hearing amalgamates the acoustic perceptions corresponding to the left and right ears respectively into a single plastic conception, which is further accentuated by individual sound differences.

Broadcasting, on the other hand, will convey to our left and right ears respectively (by the intermediary of the two head-phones) perfectly identical oral impressions, resulting in a flat and shallow sound picture devoid of any plastic perception.

Endeavours have therefore been made to devise some means by which the left and right ears might receive slightly different acoustic impressions, just as in direct listening, the right ear, in accordance with the distance separating the two ears, receives a slightly different impression from the left ear.

POSSIBLE SOLUTIONS

If two microphones separated by a corresponding distance were used as sound recorders, two separate lines of conductors being relied upon to lead the microphone currents to the left and right head-phones respectively, a sound would be heard in exactly the same manner as though the two ears were substituted for the microphones; *i.e.*, this arrangement would convey a perfectly natural, plastic (that is to say, three-dimensional) impression. If, on the other hand, the two lines of conductors between the microphones and telephones respectively are replaced by two radio transmitters and receivers, the same phenomenon would occur, resulting in a perfectly plastic acoustic picture.**

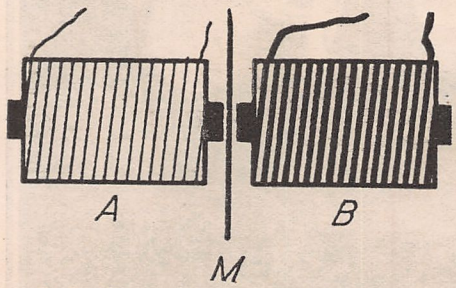


Fig. 3. The membrane, M, vibrating between two electro-magnets produces a phase displacement of 180 degrees in a telephone circuit.

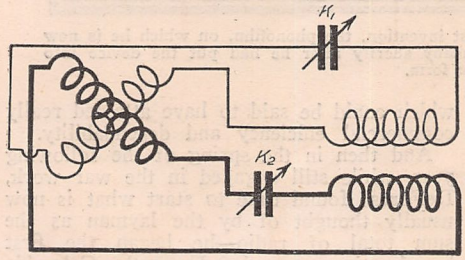


Fig. 1. Simple circuit illustrating an arrangement for setting up a phase displacement from 0 to 360 degrees using a variocoupler.

Another solution of the problem could be conceived of in theory as follows: Microphone vibrations are known to be superimposed on electric waves. Inasmuch as two microphones installed at a short distance apart are able to record the phase difference required for a plastic acoustic picture, the vibrations recorded by the two microphones could be superimposed on a single train of electric waves. The waves issuing from the radio transmitter would then carry the phase difference and the radio receiver would receive it. However, inasmuch as this phase difference is communicated simultaneously to both head-phones, both ears are bound to receive the same acoustic picture, thus excluding any actual plasticity. In fact, the electric waves generated by the two microphones respectively and carried by the same train of broadcast waves would have to be disentangled so as to cause those corresponding to the first microphone to be received by one and those recorded by the second microphone by the other head-phone. While this process in theory would seem to be quite feasible, it has not yet been carried out in actual practice.

Dr. H. Kluth, of Nauen, Germany, in his laboratory, where the stereophone circuit was developed.

THE KLUTH METHOD

A German radio engineer, Mr. H. Kluth of Nauen, has devised a process based on a phase displacement of the waves striking the broadcast receiver, the transmitter being, as usual, operated with a single microphone.

A shifting in phase of high frequency vibrations as obtained in a radio receiver could, with relative ease, be obtained with the aid of a variometer free to rotate through 360 degrees. The circuit of Fig. 1 illustrates a simple arrangement enabling a phase displacement from zero to 360 degrees to be obtained in accordance with the actual position of the variometer. If this arrangement were used in connection with the radio receiver it would entail the use of two vacuum tubes (Fig. 2), causing the original high frequency current and that shifted by a fraction of a phase to be supplied to head-phones 1 and 2 respectively. This arrange-

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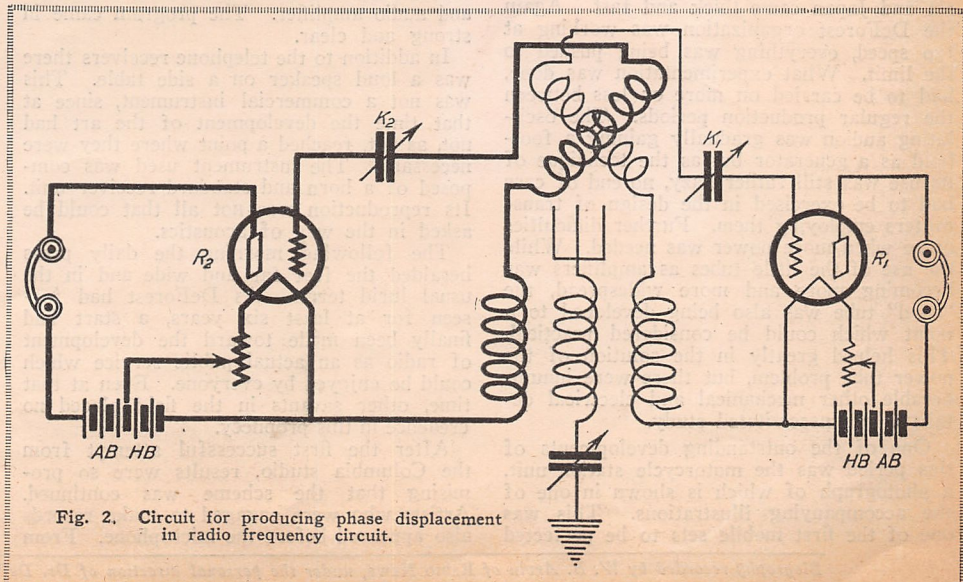
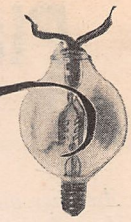
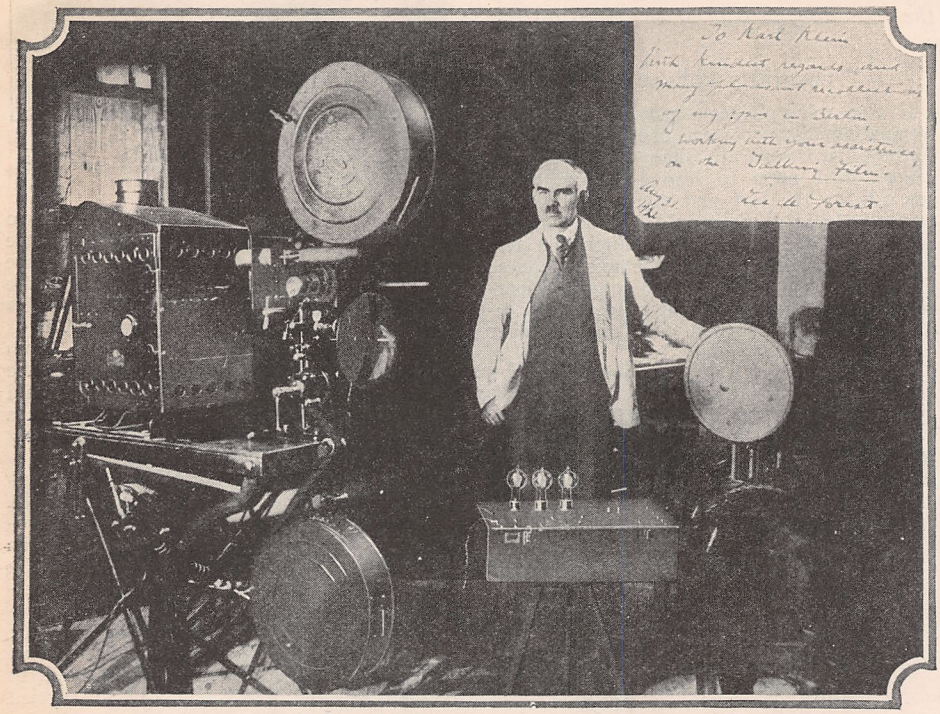


Fig. 2. Circuit for producing phase displacement in radio frequency circuit.

*Berlin Correspondent RADIO NEWS. **See RADIO NEWS, October, 1925, issue, "Stereophonic Radio."

The Life and Work of Lee DeForest





Above is shown Dr. Lee DeForest with his latest invention, the phonofilm, on which he is now working. The picture above was taken in Germany shortly after he had put the device into workable form.

CONCLUDING INSTALLMENT

IT was shortly after the first successful telephone tests between the Eiffel Tower in Paris and Arlington that DeForest returned to the United States. It was a time of great pressure and great things. The war had settled down to a steady grind and all the combatants were beginning to realize more and more thoroughly that the final outcome was to a great extent dependent upon communication. Never before had this necessity confronted military men with such dire accent. So De Forest, hardly being given time to unpack his trunks, was forced into the work of design and execution as well as development of radio apparatus and methods for use both in the firing lines and at the bases.

Commissions from England, France, Russia and Japan came thick and fast. Again the DeForest organization was working at top speed, everything was being pushed to the limit. What experimentation was done, had to be carried on more or less between the regular production periods. The oscillating audion was gradually gaining a foothold as a generator but as the technique of its use was still rather hazy, no end of care had to be exercised in the design of transmitters employing them. Further difficulties arose when more power was needed. While the use of the little tubes as amplifiers was becoming more and more widespread, the "hard" tube was also being developed to a point which could be considered practical. This helped greatly in the solution of the power tube problem, but there were innumberable other mechanical and electrical details which necessitated study.

One of the outstanding developments of this period was the motorcycle station unit, a photograph of which is shown in one of the accompanying illustrations. This was one of the first mobile sets to be perfected which could be said to have attained really commercial efficiency and dependability.

And then in the spring of the following year, while still engaged in the war work, DeForest found time to start what is now usually thought of by the layman as the sum total of radio—he began the first broadcasting, as such. From the Columbia Phonograph laboratories in 38th street, New York, he placed on the air what will be known in the history of the art as the first regular broadcast program. It consisted chiefly of records and was picked up at a public meeting in the ball-room on the roof of the Hotel Astor, where a number of celebrities had gathered to grace the occasion. A large, round dinner table was set, and at each cover there was a pair of regulation telephone receivers with head-bands. These were connected to a standard receiver and audio amplifier. The program came in strong and clear.

In addition to the telephone receivers there was a loud speaker on a side table. This was not a commercial instrument, since at that time the development of the art had not, as yet, reached a point where they were necessary. The instrument used was composed of a horn and standard receiver unit. Its reproduction was not all that could be asked in the way of acoustics.

The following morning the daily press heralded the feat far and wide and in the usual lurid terms. As DeForest had foreseen for at least six years, a start had finally been made toward the development of radio as an actual public service which could be enjoyed by everyone. Even at that time, other savants in the field placed no credence in this prophecy.

After the first successful attempt from the Columbia studio, results were so promising that the scheme was continued. Artists who were engaged to make records also appeared before the microphone. From time to time other interests were added to the program and before many months had passed letters began to pour in praising the work of the station and asking for more.

It was late summer when the station was moved to the High Bridge experimental station of the company, from where the broadcasting was continued. The *New York American* saw the advantage of the new service and installed a private wire directly to the studio, over which news bulletins were broadcast from hour to hour. The first time this service gained really wide popularity was at the presidential election in 1916. All during the night, the radio fans sat in their homes listening to the returns as they came into the editorial offices of the paper.

And then, as the musical program continued, radio dances began to be the thing. Many were held in the metropolitan district with the aid of loud speakers. All of them brought letters to the broadcasting station in appreciation of the service rendered. As for the range of the station, reports came in from the middle West and regular reception in Buffalo, New York, was common.

The work continued until April of the next year, when the government closed all amateur and experimental stations at the outbreak of the war.

Those who have been following this series will remember that all this phone work was being done with the three-electrode vacuum tube as the generator of the continuous waves which served as a carrier for the voice modulation. The Heising system of modulation had not yet been brought out and the DeForest system employed the grid method of impressing the voice current variations upon the carrier. This method is still employed in small installations and is extremely efficient.

Broadcasting would, in all probability, have made a much quicker advance into our daily life, if it had not been for the war and the consequent order of the Government closing down all experimental stations. However, such was the case, and in April, 1917, the good work which had been started came to a sudden and untimely stop.

Immediately work ceased on this track, DeForest began again to spend his spare time working at his own ideas. The Navy was anxious for some improvements in tubes. They had heard of the oxide coating, which Wenhelt had discovered in 1904, and thought it a good idea to incorporate it in the filaments of their tubes, thus decreasing the current consumption. In due time and after some necessary experimentation this feature was incorporated in the DeForest tubes made for the Navy. It was at this time, too, that DeForest specifications became standard in the War and Navy branches of the service. Our present tube base size, shape and terminal arrangement dates from this time.

U. S. ENTERS WAR

As soon as the United States made its entry into the war, DeForest was called into the service. Since the beginning of the Unpleasantness, airplanes had taken a very important place and were constantly becoming more indespensible to the various combatant forces. The one great difficulty with them was that encountered in communication to and from moving craft. The adaptation of radio to this purpose had been unsuccessful up to the time De Forest tackled

Biography recorded by W. B. Arvin of Radio News, *under the personal direction of Dr. DeForest. Copyright, 1925, by E. P. Co.*

the problem. He designed and built a combined transmitter and receiver, the power of which was drawn from a generator operated by an air propeller attached to the outside of the fuslage.

A great number of these sets were built for the service and performed their duty well. What an improvement this was over the previous method may easily be recognized when it is called to mind that the only means available before was the use of huge white sheets which could be seen by the pilot, with a shutter arrangement so fixed as to enable the ground men to make dots and dashes by alternately making the sheets visible and invisible.

During the remainder of 1916 and 1917 DeForest continued in the service of the government and finally brought out the VT 2, which is the practical basis for the present-day 201-A type tube. These found great favor in use and swiftly became the standard of the service.

Another experiment which has never been brought to final form, since the Armistice did away with the need which gave the development birth, but which nevertheless is interesting, was DeForest's conception of a buzzer radio transmitter incorporating some of the principles of the quenched spark. For reasons of power supply and portability, it would have been ideal for short-distance work.

A few years ago, after the conclusion of the war, this type of set was the subject of much experimentation among the amateurs. However, in this age of trans-oceanic communication with five watts or so of power, it has fallen into the limbo of spark transmitters and the other developments which were so important in the babyhood of the science.

DeForest was still in Paris at the time of the Armistice, and, with the remainder of the population, found himself slightly daft at the announcement of the long-awaited conclusion of the four-year conflict. Being in the thick of it for longer than a great many of his compatriots, it is forgivable that he possibly showed a bit more enthusiasm and release from strain than they.

THE EPISODE OF THE FLAG

Anyway, the tale is told that he served several hours in a Paris prison for the offense of stealing—an American flag. As luck would have it, he was busy at the hour of the announcement, so that half an hour or more elapsed between the first break of the news and the time he rushed out into the streets with the remainder of the populace. For the first few minutes after he reached the street, he seemed fairly sane. However, as the full meaning of the event became more clear in his mind, the momentousness of the occasion was borne more fully upon him.

One thing was absolutely certain. There must be some sort of celebration. Was not History being made? Was not the long nightmare which had strained the nerves of the world for four long years at last ended? Of course, there should be a celebration—riotous, mad even.

DeForest and Darby—Samuel E. Darby, the attorney who had on occasion fought for DeForest's rights in almost every possible court, who had once, even, prevented DeForest's tasting the weary, dark waters of the Hudson river while in a fit of depression—DeForest and Darby started out to give their taut nerves the long-waited release. Down the Boulevard St. Germaine they went and then across toward the Champs Elysees. The crowd all about was in gala attire and the holiday spirit was rampant. Flags everywhere. DeForest was away from home. He wanted an American flag. Hadn't the Yanks been responsible for most of it? Was he not a Yank? He *had* to have a flag. Seven shops were visited and all the keepers were sorry, very sorry, but they had sold the last American flag just a few minutes ago.

Well, if he couldn't buy one, there was only one thing to do. He had to have one. It was settled. There were tickets for the *Folies Bergère* and it was highly improper for him to go without a sign of God's own country to show the Audience. Ah, here was the chance, a nice dark corner and three flags in that third-story window—the French, the Union Jack and, boy, there was the old Stars and Stripes! DeForest told Darby his intention. The latter tried to dissuade him but it was a simple waste of breath. So up he climbed—up the stone facing of the building to the window ledge on the third floor. The thing was going successfully. A slight tug brought the flag free from its support. DeForest climbed down with a whoop. And there was where he made his mistake. A *gendarme* saw the process and, hearing the whoop, came full speed after the culprit. The chase was short and led to a police court.

The cool cell behind the court room, however, did not dampen DeForest's spirits. There was a slow dragging of time, however, and finally Darby was able to get a hearing for his client, in spite of the general disruption of schedule on account of the merry making. The judge was austere—until Darby presented DeForest's card. His Honor, it seemed, followed scientific research to some extent and knew of "the great American radio man who has so much helped the France." He was dismissed with an admonition to steal no more flags—but keep the one he had.

Dr. DeForest in a business pose. This is as he appears with his helpers in the laboratory or at the studio.

Then to the *Folies Bergère*. The show was a riot. No one followed his lines. The cast was in the same mood as the audience. DeForest had a box. Finally toward the end of the first act, there came a story of an American Doughboy. At the end, the actor cried *"Vive les Etats Unis!"* DeForest could wait no longer. He arose in his box and cried: "I'll say so!" and waved the flag above his head. There were many of his compatriots in the audience it seemed, for they arose to their feet and began to sing, shout and yell. In a word, DeForest stopped the show for America.

A few days later, his work completed and the last details settled he returned again to New York to take up his work where he had left it, more than a year before. First, however, he took a three months' vacation.

Back again at the grind, he began to cast about for openings for his broadcasting scheme. The old High Bridge station was opened and the former programs resumed. It was only a short time until the radio inspector for the New York district began to question the right of a station to broadcast. The matter was called to DeForest's attention. DeForest could not see why a duly constituted and licensed station might not broadcast, so long as it observed the rules laid down in the radio law of 1912.

In the end the inspector had his way and the High Bridge station cut off the power and ceased its daily programs.

Shortly after this, the Intercity Radio Company, which had an installation atop the World Tower in Park Row, invited the DeForest Company to continue their work at the *World*. The invitation was accepted with pleasure and in a short time DeForest was again broadcasting. Another novelty was added to the program in the form of a sort of a vaudeville bill. Vaughn DeLeath was one of the principle performers and afterward made a great hit on the legitimate variety stage through the aid of her training before the microphone and the reputation it had brought her. Meanwhile, while he had kept this work going he had established another station for the *Toronto Courier*.

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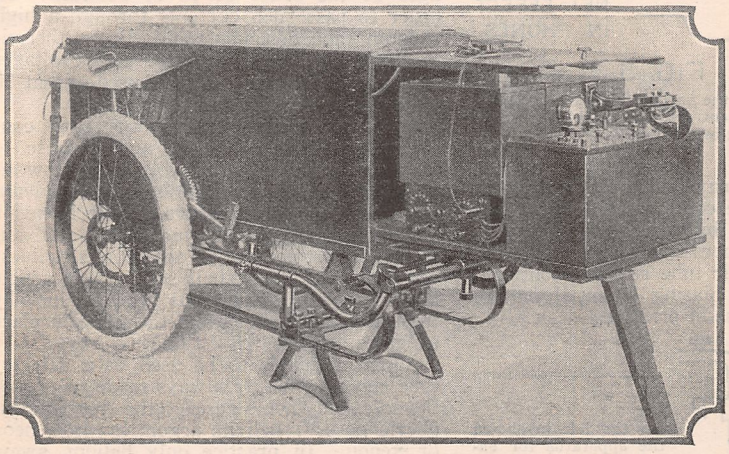
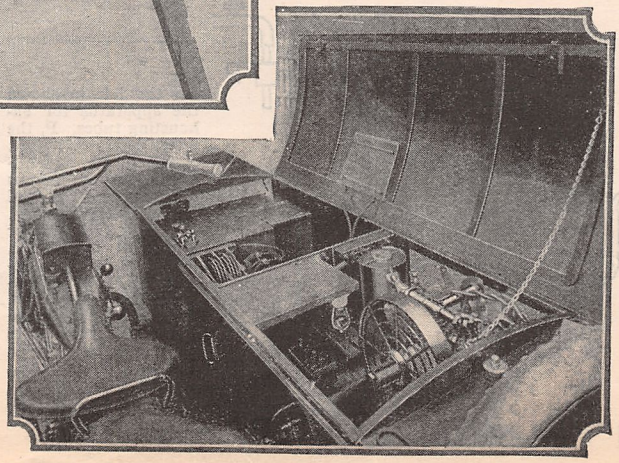


In the two photographs here are given two views of the first really dependable movable transmitter used during the World War, a development of Dr. De Forest's. This is only one of his many war-time developments made for the various allied governments.



Hot Cathode Metal Vapor Tubes

By DR. C. B. BAZZONI*

This second article by Dr. Bazzoni on gas-filled radio tubes deals with those that employ a hot cathode, or filament, and use a liquid metal as an anode.

IN the last issue of RADIO NEWS I described certain general features of vacuum tube operation in an article on "Hot and Cold Cathode Tubes as Rectifiers and Detectors." I there pointed out that, although the vast majority of the tubes used in radio have hot cathodes and are pumped to as high a vacuum as possible so as to employ the "pure electron discharge," there are nevertheless on the market a considerable variety of tubes, some with hot and some with cold cathodes, in which a sufficient amount of gas or of vapor of some

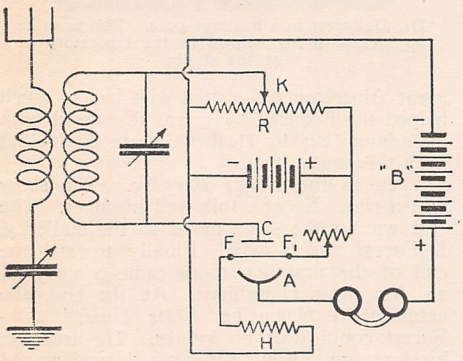


FIG. 3

The metal vapor tube is here used as a detector. FF_1 is the filament; C, the collector, and A, the liquid metal anode.

sort has been introduced to alter the tube characteristics in a fundamental way. The plate current in such tubes is largely a gas ionization current. Tubes in this latter class frequently seem most curious to the amateur, since he is not familiar with their appearance nor with the principles which underlie their operation. The editor of RADIO NEWS has consequently thought that a description of the theory of such tubes, illustrated by references to applications in particular cases, would be of interest to RADIO NEWS' readers. In this article I shall speak only of hot-cathode, gas (or vapor) filled tubes, leaving cold-cathode, gas-filled tubes for subsequent treatment.

NEED FOR MORE SENSITIVE DETECTORS

It will be recalled that the pure electron discharge of the high vacuum tubes of the 201A and 301A types, being readily and accurately controllable, renders these tubes superior for amplification work in which lack of distortion of the signals is a primary requirement. Such tubes, however, have comparatively very low sensitivity as detectors. The importance of obtaining some device with a higher detecting sensitivity than that of high vacuum, three-electrode tubes is really very great. The present popular use of radio is to be traced to the general introduction of "regenerative reception" which is, in principle, a circuit arrangement for increasing the detection sensitivity of three-electrode tubes. A tube hooked up in a regenerative circuit has a high detecting efficiency, but here sensitivity is obtained by a close approach to the production of self-sustained oscillations in the set which, unless special precautions are used, may produce destructive interference with neighboring receivers by reradiation. What is wanted is a tube having a higher sensitivity in itself without employing regeneration. Some such device is necessary to the continuation of the growth of radio in service and popularity.

GAS-FILLED TUBES

The detecting sensitivity of ordinary tubes can be much increased by introducing into the tubes a small amount of gas which, as explained in last month's article, *ionizes* at a particular plate voltage and produces a sharp rise in plate current partly due to the new electrons (negative ions) thus released and partly due to the neutralization of the negative space charge by the positive gas ions. Tubes of this kind are called "soft-tubes" and are frequently used in the detector stage of radio sets. Tube UV-200 is of this type. These tubes, to be practical, must contain, however, only very low pressures of gas. If the gas pressure be increased to the point where the detecting sensitivity is a maximum, the device becomes erratic because

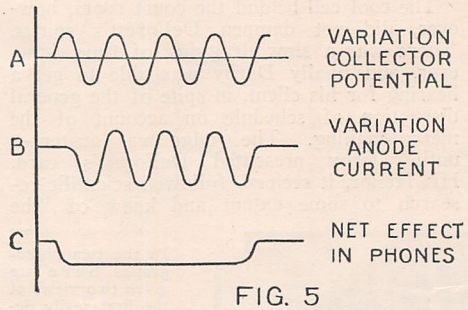


FIG. 5

In curves A and B the variations in the collector and anode current are shown, giving the resultant effect in curve C.

of the practically unavoidable changes in gas pressure due to the continual taking up and giving out of gas by the metal parts and glass walls of the tubes when the temperature changes. An erratic tube requires continual adjustment of the biasing potential on the grid and is of no use in practice.

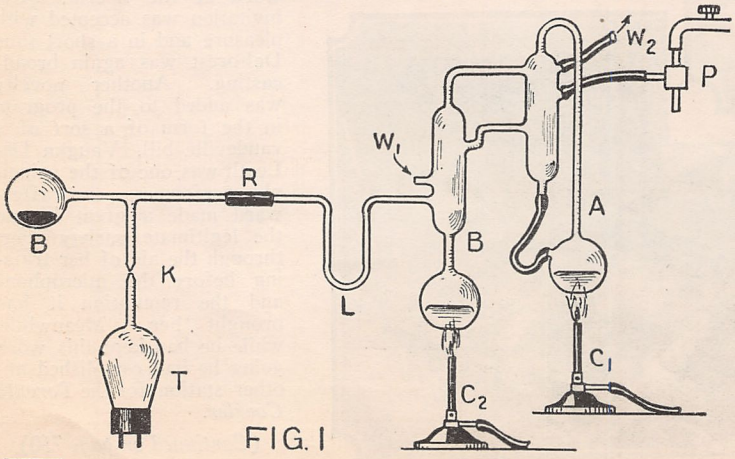


FIG. 1

To the left is shown the apparatus for exhausting tubes. P, the water aspirator pump; A and B, mercury diffusion vacuum pumps in tandem; G1 and G2, Bunsen burners; W1 and W2, water inlet and outlet; R, flexible rubber connection; K, constriction for sealing tube; B, reservoir with liquid metal; T, vacuum tube.

It is true that this erratic behavior has been eliminated in certain experimental tubes of the gas content type, stability having been attained by expert care in the preparation of the tubes and by the use of a critical gas pressure—but such tubes have not proven to be reproduceable. By this we mean that it has been impossible to devise a practical manufacturing procedure for making large numbers of these tubes exactly or even nearly alike. Each tube requires individual expert attention and adjustment in the making. These remarks show that a practical radio tube for detecting work must be sensitive,

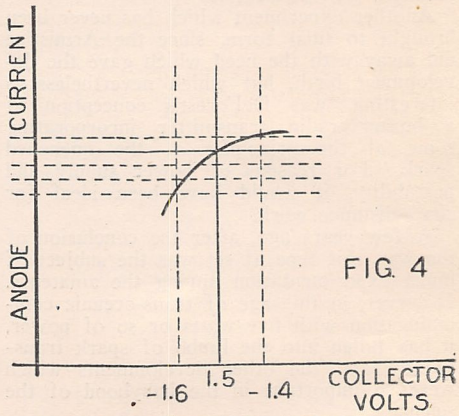


FIG. 4

Above is a portion of the characteristic curve of the metal vapor tube that can be used very efficiently as a detector.

stable and reproduceable on a commercial scale.

Tubes employing ionization have another advantage over pure electron discharge tubes in addition to their higher detecting sensitivity. Once the ionization point is passed, the plate currents through such tubes are very large, perhaps several hundred milliamperes through tubes of the ordinary detector size. These values are reached at plate voltages of the order of 18 or 20 volts. In order to pass such currents through a high vacuum tube depending entirely on thermionic emission, much higher plate voltages must, on the other hand, be used—from 90 volts up in ordinary practice.

It is, of course, advantageous from considerations of convenience and expense to keep the required plate voltage as low as possible. However, neither of the advantages cited can overbalance erratic behavior of the tubes. To make use of these advantages the first necessity is to secure steadiness of operation. We shall see in this article how nearly this result has been attained by the use of metal vapors in the tubes in place of gases.

When a gas is to be used in a detector tube choice is nearly always made of one of the so-called "noble gases" (the "rare atmospheric gases") helium, argon, krypton, neon or xenon. In practice only helium, argon and neon are used. These gases are very inert and therefore do not react with the electrodes or other parts of the tubes. They are monatomic—that is, each molecule consists of a single atom only, which makes them ionize, *i.e.*, break up under electronic bombardment, in a more simple manner than would polyatomic molecules. Their ionization points are relatively high, ranging from 25 volts for helium down to 17 or 18 volts. This voltage value is the drop through which an electron must fall in order to pick up enough energy to knock an atom of the particular gas apart into a negative ion and

(*Continued on page* 728)

Professor of Experimental Physics, University of Pennsylvania.

A Crack 40-80 Meter Set

An article is here presented that will prove of interest to those who wish to experiment on the 40-80 meter wave band.

By E. W. THATCHER

AND where is the man who said it couldn't be done? A review of the accomplishments in the field of amateur radio during the past winter would contain such stupendous developments as to stagger the most vivid imagination. Hazy dreams and aspirations of the past have become real experience—and not only that, but everyday experience to a great number of amateurs throughout the entire world. Communication across states, across continents, across oceans, to the antipodes has become the rule of the game. Communication of nearly three thousand miles at noon with less than one kilowatt input has been maintained with clock-like regularity. Through it all, we see growing that ever-increasing bond of friendship which comes through community of interest. National, geographical and racial barriers fall before the advance of amateur radio communication.

This great advance in the art owes its existence to such men as John L. Reinartz, who are ever forging ahead, discovering new facts, and opening new fields of investigation. The readers of the RADO NEWS will remember his monumental work on twenty-meter transmission.

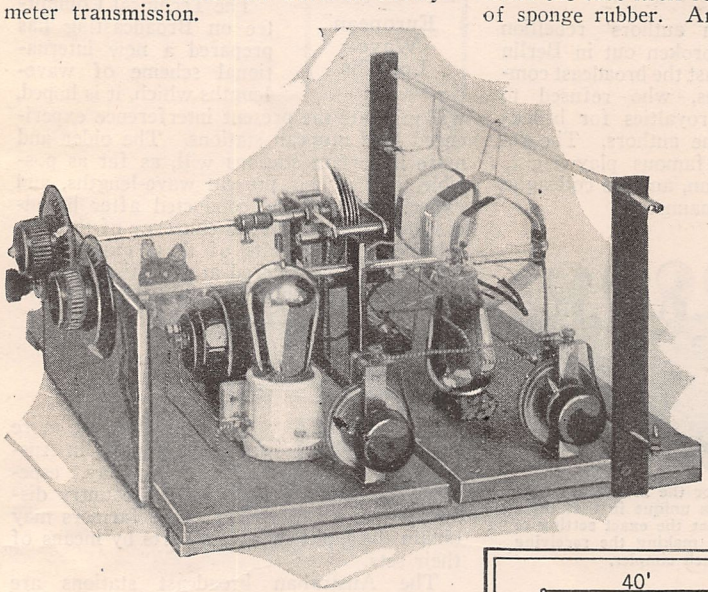


Fig. 4. On the left is the receiving equipment. The inductances are suspended from the horizontal glass rod. Note the fanned plates of the variable condenser.

The wave bands allotted to amateurs have been proven to possess widely varying qualities, but the concordant results of many experimenters makes possible a statement of the general characteristics of each.

BAND	DAYLIGHT CHARACTERISTICS	NIGHT CHARACTERISTICS
150 to 200 meters	Range, 0-200 miles Fading, nil Atmospherics, strong	Range, 0-2,000 miles Fading, bad Atmospherics, very strong
75 to 85.6 meters	Range, 0-400 miles Fading, nil Atmospherics, nil	Range, 250-5,000 miles Fading, slight Atmospherics, bad
37.5 to 42.8 meters	Range, 250-1,000 miles Fading, nil Atmospherics, nil	Range, 500-10,000 miles Fading, very slight Atmospherics, weak
18.7 to 21.4 meters	Range, 1,000-3,000 miles Fading, nil	Range, 4,000-??? Fading, nil
4.69 to 5.35 meters	Range, ?———?	Range, ?———?

While these figures are far from "hard and fast," they serve to give a basis of comparison on which to work. It can readily be seen that some of the bands have advantages peculiar to themselves and a particular kind of service. The purpose of this article is to present, in as concise a manner as possible, points in the construction and operation of a simple but efficient transmitter and receiver, capable of operation on either the 40- or the 80-meter band.

THE TRANSMITTER

The transmitter employs one so-called 50-watt tube in a Meissner type circuit (Fig. 1). The arrangement, planned to reduce the length of the leads in the oscillating circuit, is shown very clearly in the cut (Fig. 2).

The base is removed from the tube and mounted in an inverted vertical position. A small wooden box with a hole cut slightly larger than the tube furnishes the support, while the tube itself rests upon a small piece of sponge rubber. Around the edge of the box are fastened the condensers, C_3, C_4, C_5 and C_6, all of .002 mf. capacity. The left end of the box supports the grid leak. Thus, all the leads are centered around the top of the inverted tube, and may be made extremely short.

The power for the plate is supplied by a transformer which delivers 1,500 volts either side of the center tap. An electrolytic rectifier, consisting of 40 lead-aluminum cells in a "bridge" circuit, gives a pulsating unidirectional current which is ironed out by two shunt condensers of one microfarad each, and a large iron-core choke.

The radio frequency chokes are wound of 250 turns of No. 26 D.C.C. wire on a 2½-inch cardboard tube. A convenient means of telling whether in the individual case the number of turns is sufficient is to draw the blade of a wood-handled screw-driver along the surface of the coil while the set is in operation. There will be a hot spark as far back as the R.F. gets in the coil and beyond that—nothing. For the voltage and power used normally in the writer's station, the R.F. was choked out about an inch from the bottom of the coil. The undertaker should be interviewed before using a metal-handled instrument or touching the steel shank of the screw-driver during this test.

The plan followed by the writer in making the inductances will prove the solution to one of the problems that always confronts the experimenter—that of building an inductance that is at once rigid, of low resistance and productive of low dielectric loss. Strips of heavy cardboard were cut, slotted so that they dove-tailed at the center, and wound with turns of copper ribbon in lateral slits made in the cross pieces. The pancakes are supported by two parallel glass rods, on which they may be moved at will. The coils in use at the present time consist of eight turns, each of copper ribbon, for which, by the way, the ribbon sold for use as receiving antennae serves admirably.

The leads from the antenna and counterpoise are brought in through a panel of plate glass (an ex-windshield from an automobile, which was secured from the local garage at the cost of $0.00). Holes were

(*Continued on page* 690)

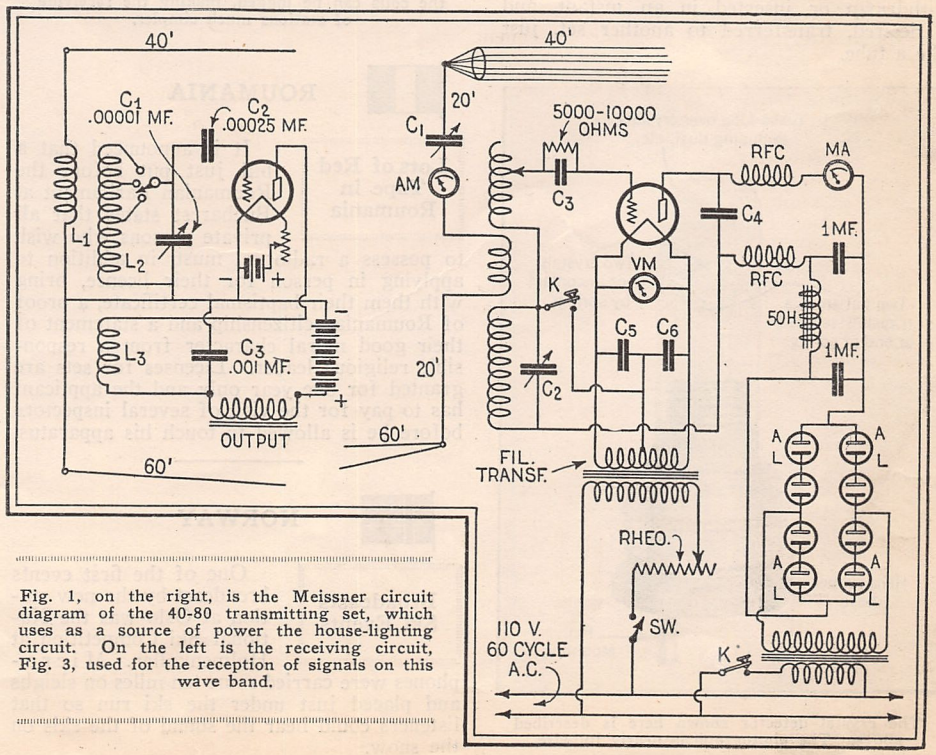
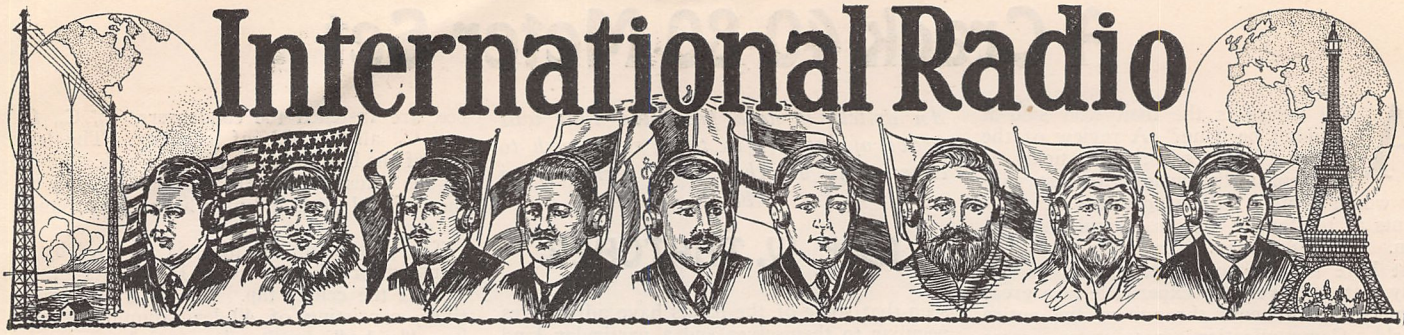


Fig. 1, on the right, is the Meissner circuit diagram of the 40-80 transmitting set, which uses as a source of power the house-lighting circuit. On the left is the receiving circuit, Fig. 3, used for the reception of signals on this wave band.

International Radio



GREAT BRITAIN

Big Ben's Microphone

The microphone which picks up the music of the chimes of this world-famous clock in London is sealed up in a special way in order to protect it against the weather. The microphone is wrapped in cotton and then enclosed in a football bladder, the latter being hermetically sealed by means of a rubber solution. The whole affair is then suspended from one of the girders about ten feet above the bells.

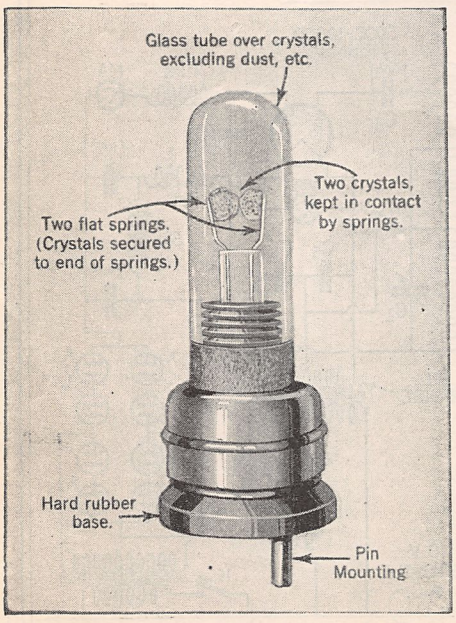
House of Lords to Have Loud Speakers

To assist hearing in the House of Lords, a British radio company is to install loud speakers, which are to be camouflaged as gilt-lined tomes to match the array of reference books.

Novel English Crystal Detector Resembles Radio Tube

A new permanent detector might at first sight be easily taken for a radio tube, so great is the resemblance between the two. Two very sensitive crystals are used in this detector, and it is claimed that no adjustment of any kind is needed. The crystals are carried on two flat springs which press the faces of the crystals lightly together.

Over the whole detector a glass bulb is placed, which excludes all dust and grit. Connection to the set is made by a pin mounting fitted to the ebonite base of the detector. In this way, the detector can be withdrawn or inserted in an instant, and if desired, transferred to another set, just like a tube.



The crystal detector shown here is described above. The photograph is nearly full-size.

The compact and rigid construction allows the detector to be freely handled without fear of disturbing the adjustment. The small size of the device will be seen from the photo; the total height is 2⅝ inches, the diameter of the glass bulb is ⅝ of an inch.

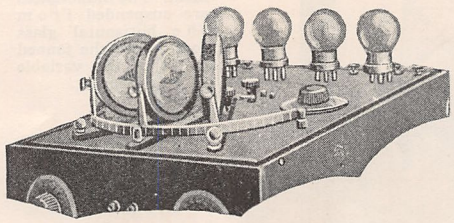
For compact crystal sets, especially of the portable type, and also for reflex sets, this detector marks a great advance over previous types, and exhaustive tests have shown that the device is all the makers claim for it.

—C. A. Oldroyd.

GERMANY

Authors' Rebellion

An authors' rebellion has broken out in Berlin against the broadcast companies, who refused to pay royalties for broadcasting the works of the authors. The revolt is headed by the famous playwright, Herr Gerhart Hauptmann, and his colleague, Herr Hugo von Hoffmannsthal.



The variable mounting for the inductance coils on the French receiver is unique in that there is a scale provided so that the exact setting of the coils can be logged, making the receiving of stations much simpler.

ROUMANIA

Lots of Red Tape in Roumania

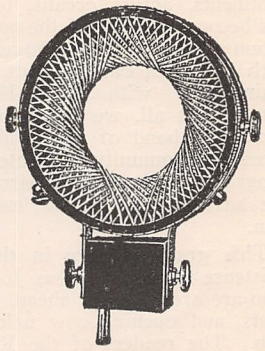
It is announced that a bill just put before the Roumanian Parliament at Bucharest states that all private persons who wish to possess a radio set must, in addition to applying in person for their license, bring with them their baptismal certificate, a proof of Roumanian citizenship and a statement of their good moral character from a responsible religious leader. Licenses for sets are granted for one year only and the applicant has to pay for the visit of several inspectors before he is allowed to touch his apparatus.

NORWAY

Broadcasts Ski Events

One of the first events broadcast by the new station at Oslo was the National Ski Competition at Holmenkollen. Microphones were carried some ten miles on sleighs and placed just under the ski run so that listeners could hear the sound of the skis on the snow.

The inductance coil shown in the accompanying illustration is designed especially for square law condensers. Besides the winding style there is another new feature, which is that the coil is mounted on its plug with a swivel mounting so that it may be swung to any angle. These English coils are made in intermediate sizes between the regular sizes.



European Wave-Lengths

The Technical Committee on Broadcasting has prepared a new international scheme of wavelengths which, it is hoped, will mitigate the present interference experienced by European stations. The older and more important stations will, as far as possible, retain their present wave-lengths, and experiments will be conducted after broadcasting hours to test the efficiency of the new scheme. The results of these experiments will then be considered at a further conference to be held subsequently in Geneva.

AUSTRALIA

Radio Increasing in Popularity

Radio is growing more and more popular in Australia every day, especially in the country districts where farmers may obtain the latest market reports by means of their sets.

The Australian broadcast stations are divided into two classes—A and B. The former participate in the money collected from license fees while the latter are run by private firms.

The main class A stations give a nine-hour service daily, using five-kilowatt Australian-made broadcast transmitters.

In this class are:

2BL, Sydney, W.L.	353	meters
2FC, Sydney, W.L.	1100	"
3LO, Melbourne, W.L.	371	"
5CL, Adelaide, W.L.	395	"
6WF, Pearth, W.L.	1250	"

There are six class A stations and thirteen class-B licensed in Australia.

The radio receiving apparatus used is mainly British or American, although several Australian firms manufacture complete sets and component parts.

—C. W. Corbin.

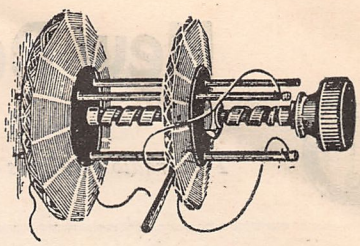
JAPAN

Japanese Radio Conditions

There are three broadcast stations in Japan: Tokyo, Osaka and Nagoya. At the beginning of broadcasting in Japan the Department of Communications issued a strict regulation concerning radio reception.

No set may be used unless approved by the authorities. Therefore, it was almost prohibitive to import radio apparatus from foreign countries. However, soon after the inception of broadcasting at Tokyo, the regulation was changed and now any set or part may be used without securing permission from the authorities.

Since then there has been a tremendous increase in imported sets and parts, over two million yen having been expended, chiefly in the United States, as Japan has adopted American standards in radio. On the other hand, home manufacturers also were very busy during March, April and May, but at present have become somewhat idle, because of overproduction, and naturally prices have dropped considerably. At present there are over 40,000 subscribers in the Tokyo district, 25,000 at Osaka and 5,000 at Nagoya. Besides these there are an equal number who have not taken out any license. A few other broadcast stations may be erected in the western and northern parts of the country. It is reported that there are over 600 radio dealers in Tokyo and another 400 radio dealers scattered throughout the Empire.



The carriage of the English basket-weave coil holder shown herewith is driven by the central screw. These carriages are so constructed that coils of different sizes may be substituted.

Esperanto Broadcast Lessons

By JAMES DENSON SAYERS*

This is the second of a series of three Esperanto lessons to be broadcast from Station WRNY on 258.5 meters. Mr. Sayers will broadcast this lesson the evening of October 24, 1925.

Comparisons are made in Esperanto as follows:

pli . . . ol, more than: **Lakto estas pli nutra ol vino,** Milk is more nutritious than wine.

malpli . . . ol, less than: Vino estas **malpli nutra ol lakto,** Wine is less nutritious than milk.

la plej, the most.

la malplej, the least: **El ĉiuj liaj amikoj, Johano estas la plej saĝa, kaj Georgo la malplej saĝa,** Of (el, out of) all his friends John is the wisest, and George the least wise.

ju pli . . . des pli, the more . . . the more: **Ju pli li lernas, des pli li deziras lerni,** The more he learns, the more he wishes to learn.

ju malpli . . . des malpli, the less . . . the less: **Ju malpli li laboras, des malpli li recevas,** The less he works, the less he gets (receives).

ju pli . . . des malpli, the more . . . the less: **Ju pli li fariĝas granda, des malpli li estas forta,** The larger he becomes the less strong he is.

ju malpli . . . des pli, the less . . . the more: **Ju malpli li pensas, des pli li parolas,** The less he thinks, the more he talks.

ADVERBS OF TIME

Adverbs of time are words that tell when, where or how some action took place. **Ili sidas tie,** they sit **there; ŝi restos hejme,** She will remain **at home; Li iros vespere,** He will go **in the evening.**

Hieraŭ, yesterday; **hodiaŭ,** today; **morgaŭ,** tomorrow, adverbs of time.

Adverbs may be formed from any word whose sense admits of it, especially from adjectives, by means of the adverbial termination **e,** as **bona,** good; **bone,** well; **antaŭ,** before; **antaŭe,** previously or formerly; **mateno,** morning, **matene,** in the morning; **sekvi,** to follow; **sekve,** consequently (lit., **followingly).**

AFFIXES AND CORRELATIVES

Two vastly important parts of the Esperanto language are the affixes and the ingenuous table of correlatives, especially the former. The root words in Esperanto are comparatively small in number, but their power of variation into almost infinite nuances of meaning add tremendously to the vocabulary. Consequently, one knowing about one thousand of the more frequently used Esperanto roots should command a vocabulary of twenty-five thousand words, a wider command of speech than ever possessed in any national language.

A few of the more often used affixes will be explained here, but because of the limited space and time on the air, the full list of nearly forty affixes will not be given here. As every affix is a separate and distinct word in itself and can therefore be found in any inexpensive Esperanto dictionary, and as you will each have to acquire some such dictionary for further use of Esperanto, it will be easy for you to learn the others. The "Edinburgh" dictionary, which costs only 75 cents, contains a list of the affixes on page IX. As the dictionaries do not always give the table of correlatives, it will be given here.

Mal—. Perhaps the most important affix in Esperanto. It reverses the meaning of any word which has an opposite meaning, thus reducing very extensively the number of arbitrary words one must memorize. Examples: **Bona,** good; **malbona,** bad; **dekstre,** right, **maldekstre,** left; **helpi,** to help; **malhelpi,** to hinder; **fermi,** to shut, **malfermi,** to open; **varma,** warm: **malvarma,** cold.

—in—. This suffix indicates the feminine sex: **Viro,** man, **virino,** woman; **onklo,** uncle, **onklino,** aunt; **knabo,** boy, **knabino,** girl; **patro,** father, **patrino,** mother.

—ist—. This suffix denotes one who occupies himself or herself in some activity professionally: **Juĝi,** to judge, **juĝisto,** a judge; **kanti,** to sing, **kantisto (kantistino)** a professional singer; **kuraci,** to cure, **kracisto,** a physician.

—ig— and —iĝ—. Two much used suffixes. **—ig—** means to **compel** or **cause** some one or something to do that which the root indicates. **—iĝ—** means to **become** so or such **oneself.** Thus from **ruĝa,** red, we get **ruĝiĝi,** to become red, to blush; **klarigi,** to make clear, to explain, **klariĝi,** to become clear; **sidigi,** to cause to be seated, to seat some one; **sidiĝi,** to become seated. **(Bonvolu sidiĝi,** please be seated).

—eg— and **—et—** are opposites. **—eg—**

(*Continued on page* 738)

TABLE OF CORRELATIVE WORDS

	I INDEFINITE. *Some, any.*	K INTERROGATIVE RELATIVE *What, which.*	T DEFINITE. *That.*	C COLLECTIVE. *Each, every, all.*	Nen- NEGATIVE. *No, none.*
QUALITY Kind of (Adjectival)	**Ia** Some or Any kind	**Kia** What kind As	**Tia** That kind Such, as	**Cia** Each kind Every kind	**Nenia** No kind
MOTIVE Reason (Adverbial)	**Ial** For some reason Any	**Kial** Why	**Tial** For that reason Therefore	**Cial** For every reason	**Nenial** For no reason
TIME (Adverbial)	**Iam** At some time Any time Ever Once	**Kiam** At what time When	**Tiam** Then	**Ciam** Each time Every time Always	**Neniam** Never
PLACE (Adverbial)	**Ie** Somewhere Anywhere	**Kie** Where	**Tie** There	**Cie** Everywhere	**Nenie** Nowhere
MANNER (Adverbial)	**Iel** Some way Somehow	**Kiel** How In what way As, like	**Tiel** In that way So	**Ciel** In every way	**Neniel** No way
POSSESSION (Pronominal)	**Ies** Someone's Anyone's	**Kies** Whose	**Ties** That one's	**Cies** Each one's Everyone's	**Nenies** No one's
A THING NOT SPECIFIED (Noun)	**Io** Something Anything	**Kio** What thing	**Tio** That thing	**Cio** Everything	**Nenio** Nothing
QUALITY (Adverbial)	**Iom** Some A little	**Kiom** How much	**Tiom** So much	**Ciom** All the quality	**Neniom** None
INDIVIDUALITY (Pronoun)	**Iu** Someone Anyone	**Kiu** Who Which	**Tiu** That (person or specified thing)	**Ciu** Each Every *Ciuj* all, all the	**Neniu** No one Nobody

*President, New York Esperanto Club.

New Designs in Radio Receivers

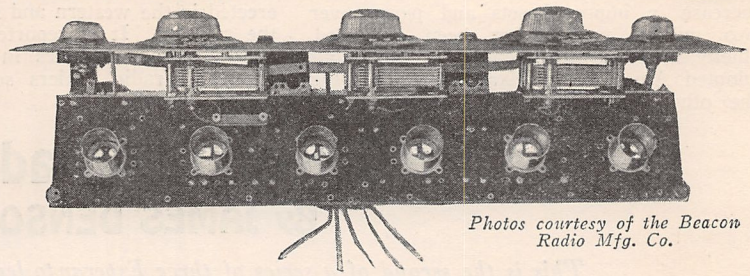
By G. C. B. ROWE

Two radio receivers are described below that have incorporated several new features of both electrical and mechanical interest.

In last month's RADIO NEWS we showed our readers a few of the newer designs in radio receivers, and in this present article are two more.

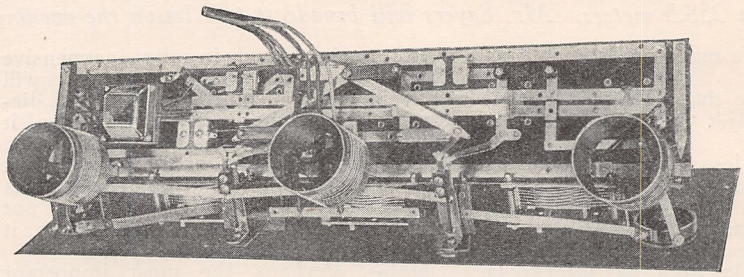
Just as the automobiles, at the beginning, were oscillating from chain to gear drive, or from overhead valves to valves underneath, so radio design is beginning to try the unbeaten paths.

But note that the tendency is toward simplicity of control. In the near future radio receivers will be going down the endless belt in the process of assembly just as the Fords do today.—EDITOR.

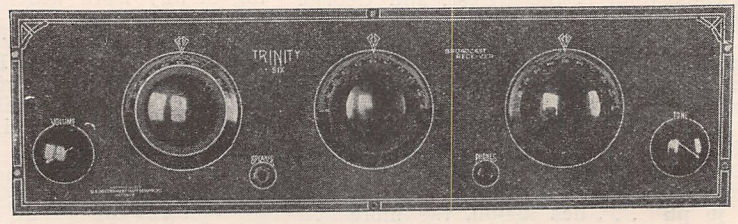


The top of the receiver. The strips shown below form the contacts in the tube sockets, eliminating over twenty soldered connections.

Photos courtesy of the Beacon Radio Mfg. Co.



The "chassis", or the sub-panel, showing the connecting strips, the coils, the straight-line frequency condensers and battery leads.



The panel view of the receiver. This panel is of aluminum finished in black, with silver etching.

THE majority of the receivers that have appeared on the market this fall have had some innovation, in either their electrical or mechanical design. Some of the sets have been vested with new tuning controls and a reduction in their number, others have circuits that are possible only because of the improved apparatus employed, while others are of interest because of the general method of design and manufacture.

In this last classification belongs the receiver shown in the photographs below. The circuit used is basically the tuned radio frequency circuit of Shloemilch and Von Bronk and has six tubes, two stages of tuned radio frequency amplification, detector, one stage of transformer coupled and two stages of resistance coupled audio frequency amplification. The set is licensed to use 88 U. S. Government radio patents that are owned by the U. S. Navy Department.

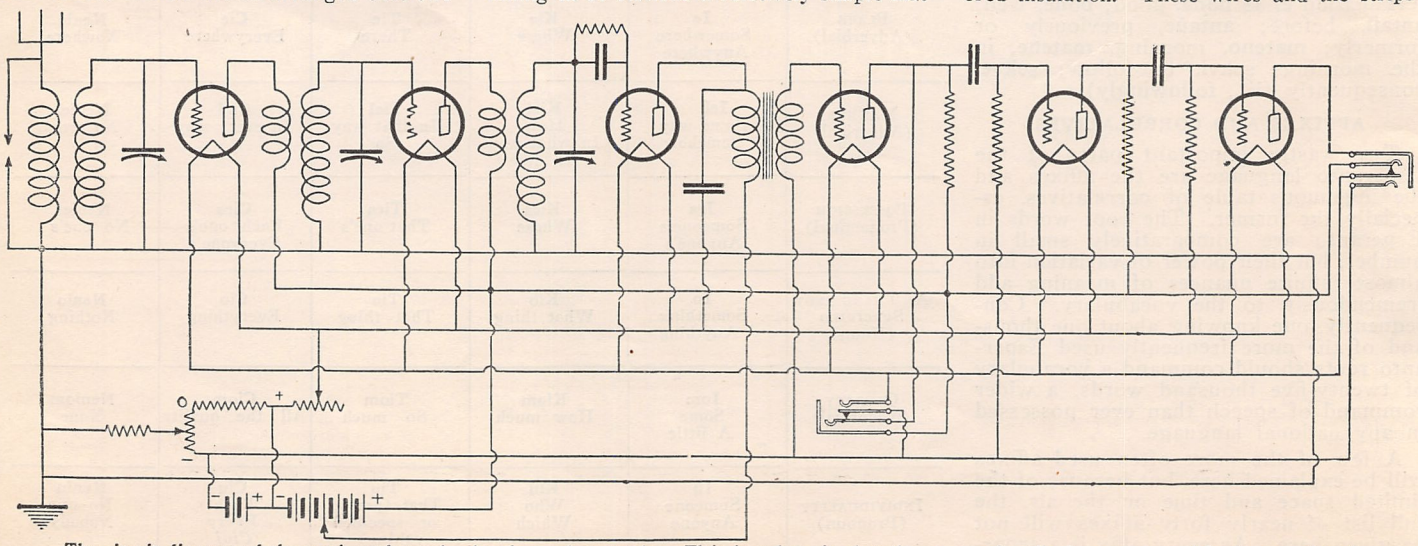
UNUSUAL FEATURES

Instead of the usual type of wiring using busbar the connections in this set are made with wide nickeled bronze strips, which are fastened securely to the sub-panel by eyelets. The sub-panel is attached to the aluminum panel at such an angle that it is horizontal when the front panel at an angle of 60 degrees. Under the sub-panel are mounted all the electrical parts and above it are mounted by eyelets the six tube sockets. These sockets are so arranged that two pieces of continuous metal take the place of the usual contact strips and connecting wires. All connections that carry plate voltage, as well as the repeating resistance of the two resistance coupled amplifiers, are mounted on one-inch high bakelite insulators. All resistances and condensers in the amplifier unit are directly connected to the strips that serve as the contacts for the tube prongs, thus eliminating leads and soldered connections.

THE CIRCUIT

The circuit, as has been mentioned above, is one employing tuned radio frequency. The condensers that are shunted across the radio frequency transformers are those of the straight-line frequency type, making the tuning in of stations a relatively simple matter, as there is a constant difference in logging throughout the entire range. Another feature that facilitates tuning is the fact that the head-phones can be inserted into the jack in the plate circuit of the first stage of audio frequency amplification and at the same time the loud speaker may be operating from the sixth tube of the set. This means that it is possible to have the loud speaker in one part of the house and in another part the receiver, which may be tuned without disconnecting the loud speaker. The insertion of the phones in the first stage of audio frequency does not appreciably impair the volume of the last stage's output.

The exterior connections of the receiver are made by five wires having different colored insulation. These wires and the strips



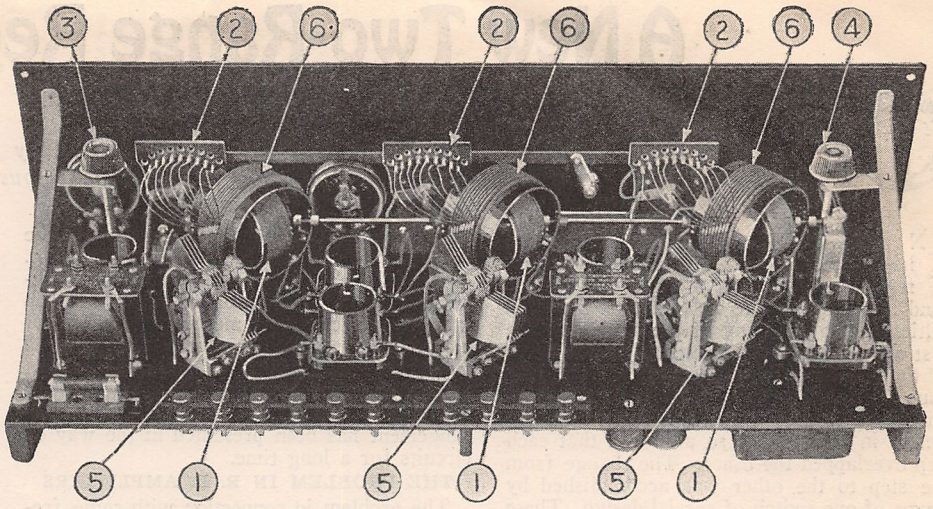
The circuit diagram of the receiver shown in the above photographs. This is unique in that the stages of audio frequency amplification consist of one stage transformer and two stages of resistance coupling.

that are connected to the phone jacks are the only soldered connections in the set. The panel is 28 inches in length and is mounted in the cabinet so that it slopes at an angle of 60 degrees. In the mahogany-finished cabinet there is space provided for "B" batteries behind the sub-panel. The antenna which is recommended for this set is one about 75 feet long, although an indoor antenna may be used. This means that the receiver, as designed, is efficient on almost any type of antenna.

SIMPLIFICATION OF CONTROLS

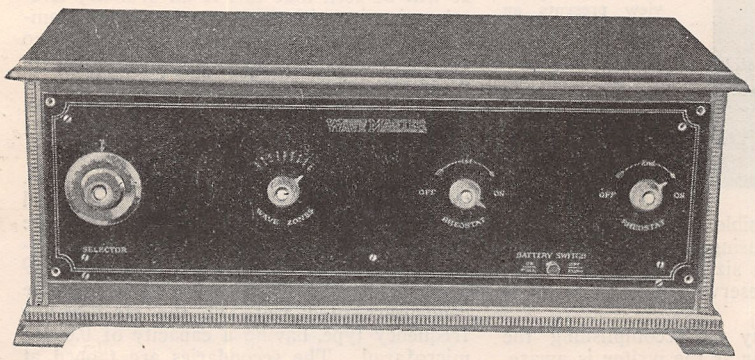
Another receiver that has new features in both the electrical and mechanical details is shown in the photographs below. This receiver employs five tubes, which act as two stages of radio frequency amplification, detector and two stages of audio frequency amplification.

Instead of using variable condensers to tune the three inductances before the detector tube, as is usual with receivers of this type, the secondaries of the coupler and R.F. transformers are wound in two sections, one on the same tube as the primary and the other on a smaller tube which rotates within the larger one. These three variable secondaries are mounted on a shaft that runs parallel with the front panel and is controlled from the front of the panel by the large dial, which operates the shaft by means of a gear train. The part of the secondaries that are wound on the larger tube is tapped at nine places, and these taps are connected to three inductance switches. The variable arms of these switches are also connected and controlled from the front of the panel by means of the small knob marked "Wave Zones." The rough tuning is performed by this knob and the finer adjustments made by varying the movable secondaries.



The interior of the five-tube receiver. The coils marked 1 are the rotors on which are wound part of the secondaries; the parts, 2, are the inductance tandem switches; 3 and 4 are filament rheostats; the condensers, 5, are the semi-fixed capacities across the secondaries, and the coils marked 6 are the primary and part of the secondaries.

The variable condensers that are shown shunted across the secondaries of the radio frequency transformers and the coupler are variable in form only, as once they are adjusted for any given antenna it is unnecessary to change the settings. By this means it is possible to have but one control for tuning, as it is much easier to operate a gang inductance than it would be to do the same with condensers on the same shaft.

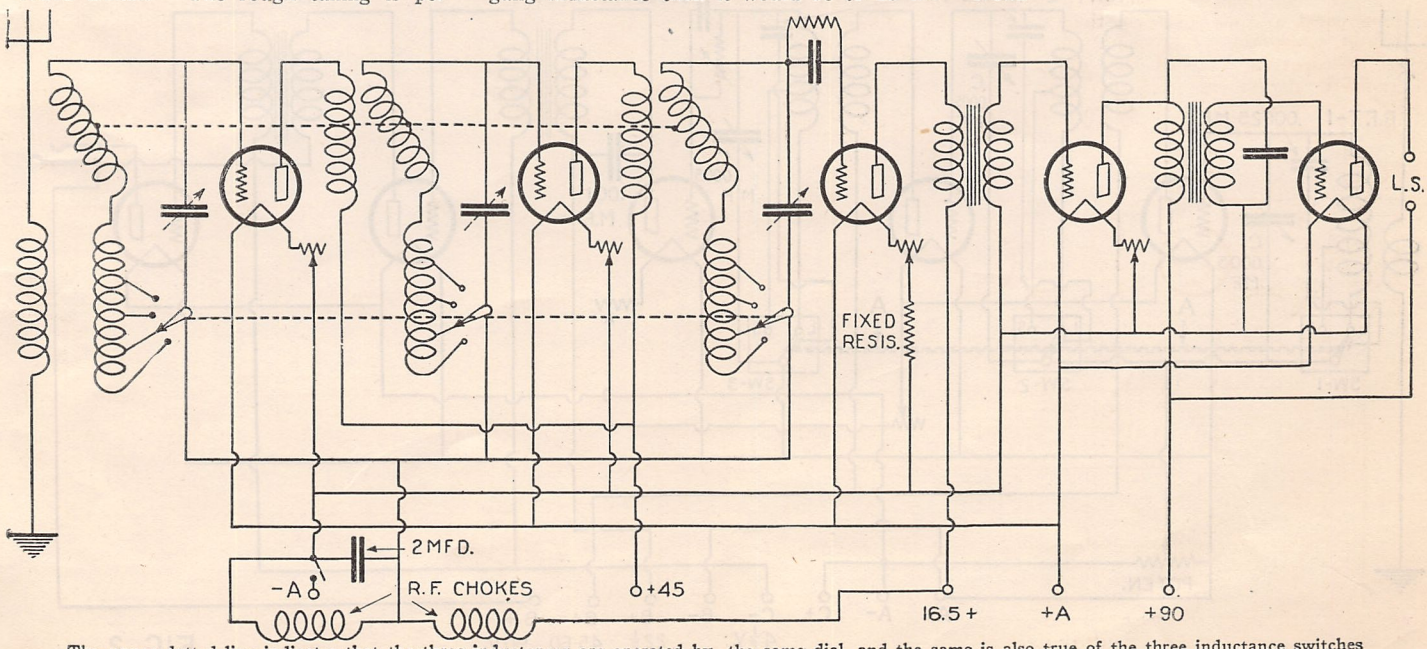


Panel and cabinet of the five-tube receiver, the interior of which is shown above. All the exterior connections are made at the rear of the set, leaving the front free from unsightly wires. *Photos courtesy of Kellogg Switchboard and Supply Co.*

MECHANICAL CONSTRUCTION

The sub-panel is at an angle of 90 degrees to the front panel, both of which are of bakelite, and on the sub-panel is mounted all the apparatus. This apparatus is so mounted that there is a minimum of possible interference and also provision made for the shortest possible connections. The mounting of the tube sockets is unique and eliminates microphonic noises to a great extent, if not entirely. On two sides of the sockets there is a brass bushing about ¼-inch high to which is secured a thin strip of insulating material. From the other two sides of the socket are suspended two other strips of the same material, which are interwoven with the first two mentioned. These strips successfully take up any vibrations that might be transmitted to the elements of the tubes, producing the annoying noises.

The receiver is housed in a cabinet 28x11½ inches. Binding posts are provided for external connections at the rear of the sub-panel and these connections are made through the rear of the cabinet. Two of the filament control rheostats are mounted on the front of the panel and the other two controls are placed inside the cabinet at the front.



The upper dotted line indicates that the three inductances are operated by the same dial, and the same is also true of the three inductance switches similarly connected. The three variable condensers, after being once adjusted, remain untouched.

A New Two-Range Receiver

By SYLVAN HARRIS

This is the third multi-range receiver that has been developed by the Laboratory Staff of RADIO NEWS. *The wave-length range is changed by an ingenious switching arrangement.*

IN previous issues of RADIO NEWS we have presented to our readers several methods of covering the present wave band in such a way as to overcome the difficulties due to crowding of the stations. The first arrangement was presented in the form of the "Three-Range Receiver" in the July issue of RADIO NEWS. The wave range of this receiver was from 140 meters to 600 meters in three steps, so arranged that each step overlapped the other. The change from one step to the other was accomplished by means of one switch of special design. These ranges were: 140 to 240 meters, 220 to 420 meters and 400 to 600 meters.

In each of these steps the whole condenser was used, so that by this means not only was a very great wave band covered, but it was covered in such a way as to eliminate crowding of the stations. The reason for this is that the whole range is spread over three revolutions of the condenser dial. This circuit became exceedingly popular with our readers, if the hundreds of letters we have received from them offers any criterion for judgment.

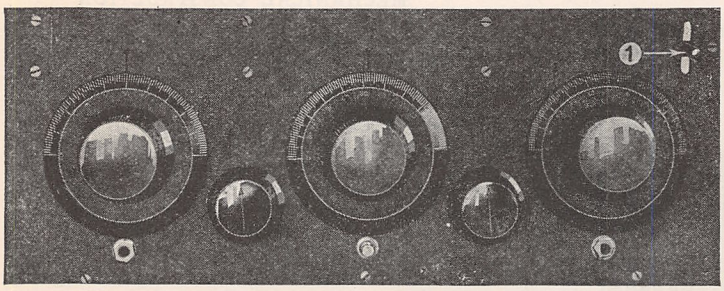
The need for multi-range receivers is explained in the article entitled "Extending the Broadcast Range," by the writer, in that issue of RADIO NEWS. If it is desired to cover a great wave range, as from 600 to 150 meters (see June RADIO NEWS, "Broadcast Stations on 150 Meters") it will be necessary to do this in two or more steps.

The "Three-Range Receiver" was a three-circuit tuner. The problem in connection with this circuit was merely the design of a special switch to perform the required functions. The switch as presented in that article, designed by the writer, works very well; it is doubtful if a more efficient arrangement has been presented in the way of circuits for a long time.

THE PROBLEM IN R. F. AMPLIFIERS

The problem in connection with radio frequency amplifiers is quite different, as there are several circuits in which the wave range must be split up. They may be split up easily by using a separate switch to tap each R.F. coil, but obviously this does not agree with the modern tendency to make the controls as few as possible. The range may be split up easily by using a number of plug-in coils of various sizes, but this likewise does not help to preserve simplicity of operation.

The simplest way of accomplishing the desired result, as far as the writer is aware, is by the means described in this article. Each of the tuned R.F. secondary coils is tapped at a convenient point, depending upon how one wishes to split up the range, and all of these tapping switches are controlled simultaneously by the same lever or rod.



The front panel view presents an attractive appearance. Note the switch-lever marked "1" at the upper right-hand corner.

The arrangement is shown in Fig. 1, which is a sketch of the switches. The construction is very simple, as can be seen from the illustration. The switches are made, in the ordinary manner, of a few switch points, a switch contact lever, a long bakelite or hard rubber rod, and a few odds and ends.

The reason for separating the various switches from one another is obvious to anyone who knows the difficulties that arise in radio frequency amplifiers from inter-stage coupling. If it were not for these R.F. difficulties, it would be feasible to bring all the tap wires into a single switch on the panel, instead of using the three switches, as shown here. Obviously, if this were done, the wires in the various tuned circuits which carry currents of radio frequencies would be very close together and difficulty might be experienced in controlling the tendency toward self-oscillation.

WIRING AND COILS

The wiring diagram is shown in Fig. 2. It will be seen that this is an ordinary five-tube circuit, with two stages of R.F. amplification, electron tube detector, and two stages of audio frequency amplification, with potentiometer control. The switches are plainly shown on the diagram, together with the rod of insulating material which controls them.

The coils used in the set are ordinary R.F. tuned transformers, which anyone may wind for himself upon a pin-board. The average diameter of the coils is 3 inches, the primary has 6 turns, and the secondary 39 turns of No. 24 D.S.C. wire. The variable condensers used were of the straight-line frequency type, having a capacity of 0.00037 microfarad. The secondaries are tapped at the 15th turn from the grid end of the coils. The general layout of the apparatus may be obtained from the photographs shown here.

It will be noted that in the wiring diagram and in the photographs a fixed condenser is shown connected between each switch and

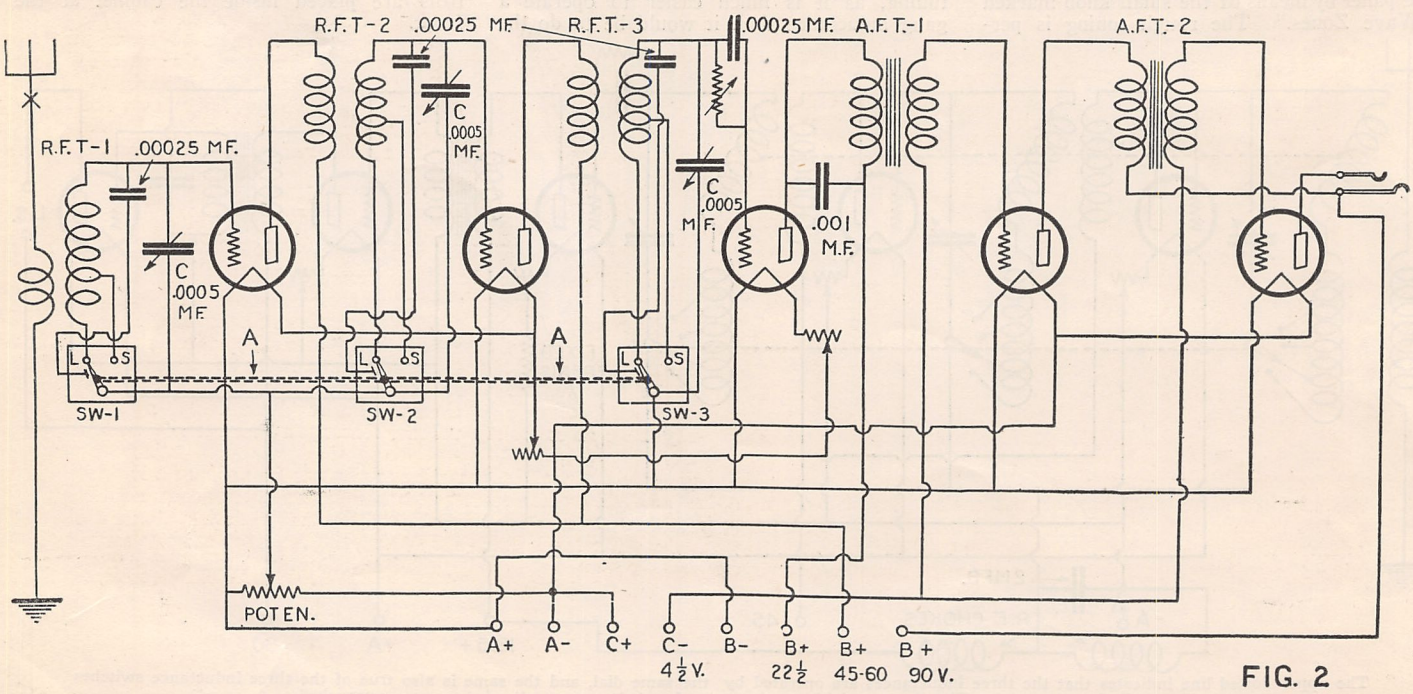


FIG. 2

Circuit diagram of the receiver. The three switches are interlocked by the rod shown in broken lines. Note especially the connections of the fixed condensers in each tuned circuit.

the coil. The reason for this can be determined from a study of the two wave ranges which are obtained by means of the tapping switches, when the fixed condensers are not used. Without the fixed condensers the upper range is about 500 meters to 240 meters. The lower range is from about 370 meters to 130 meters. It will be noted from these ranges that the wave-lengths between 370 and 240 meters can be tuned in on either position of the switches.

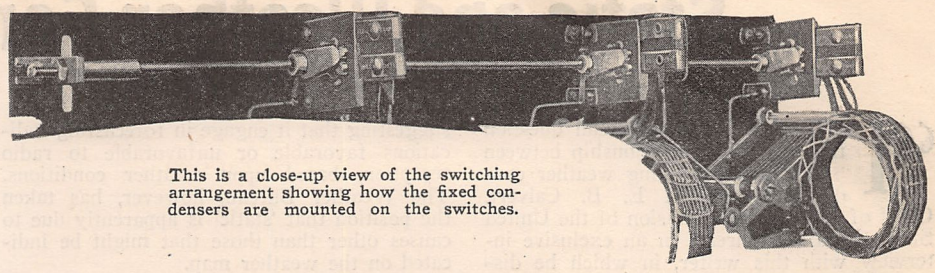
This is not advantageous, for part of the circumference of the dials is wasted, and it is not possible to take full advantage of the ability of the system to separate the stations on the dials to the fullest extent. For this reason the lower limit of the upper range is raised to about 350 meters by means of the .00025 fixed condensers. The ranges are then:

Upper range ..... 570 to 350 meters
Lower range ..... 370 to 130 meters

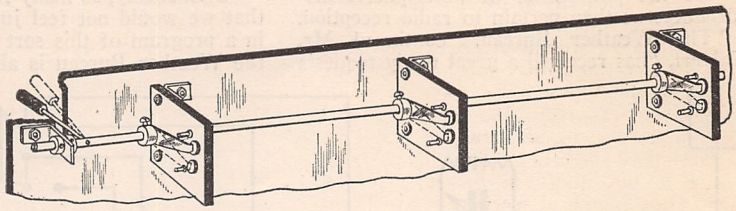
It is seen that the overlapping of the two ranges is now only between 370 to 350 meters. This is sufficient overlap so that no stations will be lost in changing from one range to the other, and at the same time is small enough so that no detriment is offered to the station-separating ability of the receiver.

MANY VARIATIONS POSSIBLE

The idea is subject to many variations, as one may imagine, and furthermore, may be applied to many types of receivers, where switching or tapping is feasible. The switches may be very easily tied together by wires or springs, or they may be controlled by means of a rack and pinion. The particular method employed depends upon the experimenter's adeptness with tools, or the conveniences which he may happen to have in his workshop. It is also possible to split up the range into more than two steps, as we have done here, and also possible to make the set cover almost any practical range desired.



This is a close-up view of the switching arrangement showing how the fixed condensers are mounted on the switches.



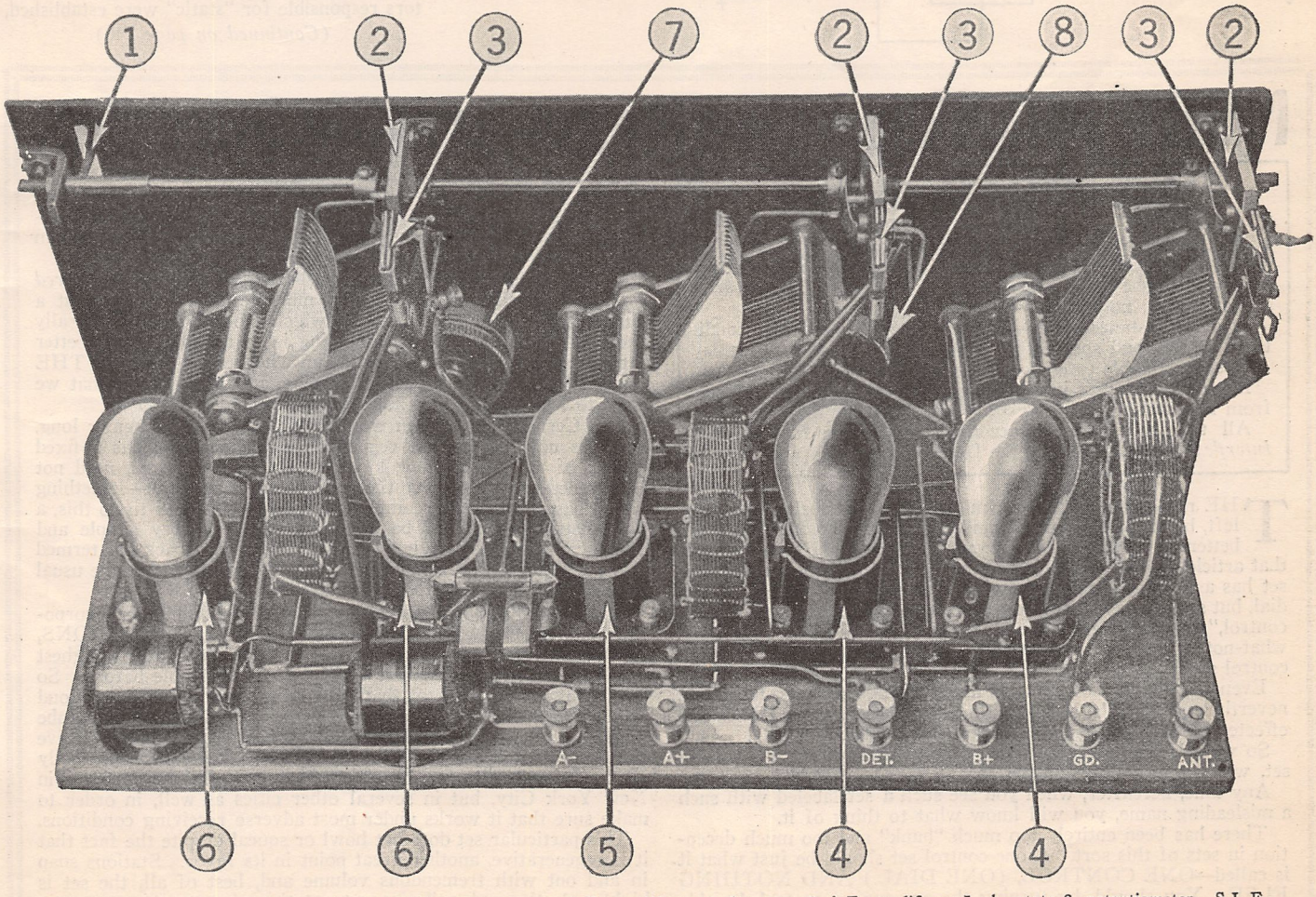
A diagrammatic view of the above photograph. The fixed condensers are not shown but the construction of the switch is plainly indicated.

The advantages of using arrangements of this sort have been discussed before in RADIO NEWS, especially in connection with the articles mentioned above. Not only are the stations spread out over two revolutions of the tuning dials, but we have also the advantages of the straight-line frequency condensers, as outlined in the writer's article on that subject in the August RADIO NEWS. Of course, the system here described is not limited to straight-line frequency condensers; any type may be successfully used, and it will be found that the stations will be spread a-plenty, even when using the ordinary semi-circular plate condenser.

This receiver has been used for some time by the writer and very satisfactory results have been obtained with it, especially in the way of reducing interference. Interference is generally more noticeable in the large cities where several broadcast stations are located near each other. With this receiver it is a very simple matter to tune out the local stations and receive distant stations.

As shown in the photographs, little space on the baseboard was wasted. It is, of course, not necessary to use as small a baseboard as is shown here, but one of the interesting points about this receiver is the small space it takes up, in spite of all the apparatus used in it. The layout of apparatus is such that there is little, if any, reaction between the several tuned circuits. The only place where difficulty was experienced was in locating the audio frequency transformers, and for this reason the smallest transformers on the market were selected.

The quality of reproduction is very good, and the distance the set brings in is as good as can be expected with this type of receiver.



1, switch lever; 2, switches; 3, fixed .00025 condensers; 4, R.F. amplifiers; 5, detector; 6, A.F. amplifiers; 7, rheostat; 8, potentiometer. S.L.F. condensers are used. Note the long bakelite rod operating the three switches simultaneously.

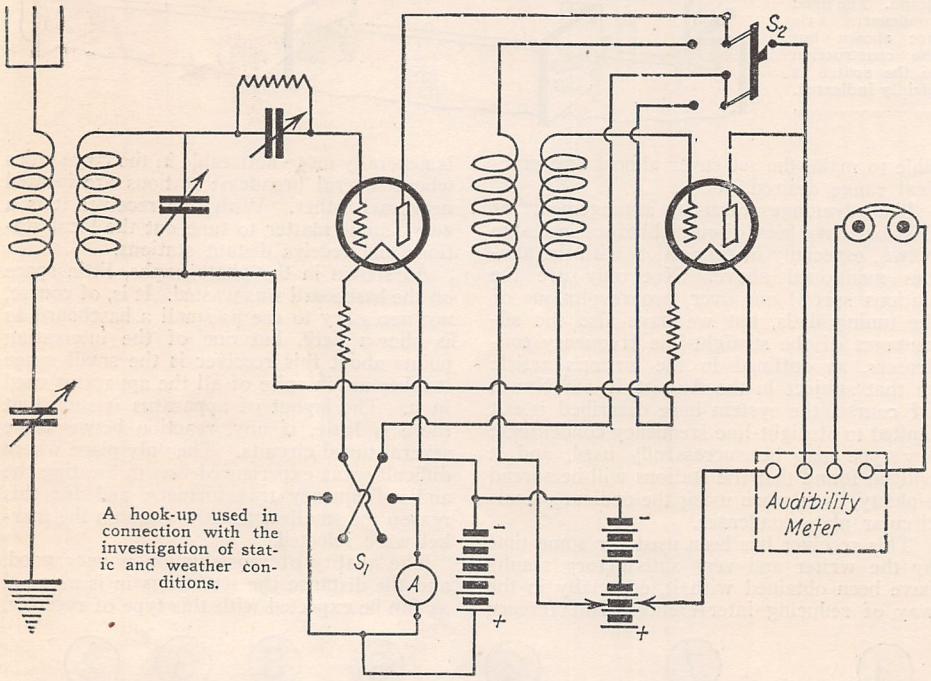
Static and Weather Forecasting

By S. R. WINTERS

"I DO not think anyone can question that there is a relationship between 'static' and prevailing weather conditions," declared E. B. Calvert, Chief of the Forecast Division of the United States Weather Bureau, in an exclusive interview with this writer, in which he discussed the phenomena of atmospheric disturbances as they pertain to radio reception.

"The Weather Bureau," continued Mr. Calvert, "has received a great many requests suggesting that it engage in forecasting indications favorable or unfavorable to radio reception, based upon weather conditions. The Weather Bureau, however, has taken the position that 'static' is apparently due to causes other than those that might be indicated on the weather map.

"Undoubedly, so many factors are involved that we would not feel justified in engaging in a program of this sort until such time as the Weather Bureau is able to collect sufficient statistical data to have the matter thoroughly studied and investigated, thus having assurance that reliable forecasts of the kind desired can be made. Such an investigation would require considerable expense in the collection of data, the compiling of same, and the personnel for conducting the investigation. At this time the Weather Bureau has not the funds to devote to the project."



A hook-up used in connection with the investigation of static and weather conditions.

RADIO MAY FORECAST WEATHER

This government bureau, the largest weather-forecasting organization in the world, is not prepared to deny or confirm the theory that radio instruments in the future may be used in foretelling changing weather conditions. However, the factors are so variable that the crashing noises in the radio receiver cannot be accepted as a reliable index of what the weather will be on the morrow. For instance, during the summer atmospheric disturbances may be unusually severe when a cloud as big as your hand is not discernible on the horizon. Again, the thundering, crashing noises that interrupt the music in your radio receiving set may be attended by an electrical storm in the making. All of which would seem to indicate that "static" is not only a bugbear to radio reception but is extremely erratic in its performances.

The Weather Bureau would contend that "static" is equal to X— an unknown quantity. That is to say, while there is a definite relationship between "static" and the prevailing conditions of the weather, other factors are involved which befuddle any attempt at a well-defined definition of the causes and actions of this enigma and chief obstacle to radio reception. Even if the origin and factors responsible for "static" were established,

(*Continued on page* 740)

NEXT MONTH—The Regenerative Interflex

What An Ideal Set Should Do

ONE single, solitary control—NO MORE!

A set your grandmother can operate.

Tremendous volume from 3 tubes, equaling or bettering most 4-tube sets.

No squeals, no howls.

A great distance-getter—1,000 miles under average conditions on the loud speaker.

A set adaptable to *all* local conditions.

Extreme sharpness in tuning, so that you can separate locals from DX stations.

All this and more is accomplished in the *Regenerative Interflex* fully described in the December issue.

THE radio public has been misled and bamboozled right and left, by radio constructors and publishers who ought to know better, in regard to single-control sets. Right along, this or that article appears, featuring a single control, when in reality the set has as many as seven controls. Perhaps it has a single tuning dial, but stuck away somewhere there was a potentiometer, a "tone control," a "stabilizer," several handfuls of rheostat knobs, and what-not. These all masqueraded under the name of a "single-control set."

Even if a number of controls are filament rheostats, these are, nevertheless, controls, because in most of these sets no DX can be effected unless the filament voltage is regulated carefully.

So we ask the question, "Why dub a 7-control set a 1-control set, when it is nothing of the sort?"

Any time, hereafter, when you see such a set labeled with such a misleading name, you will know what to think of it.

There has been entirely too much "bunk" and too much deception in sets of this sort. A one-control set should be just what it is called—ONE CONTROL, (ONE DIAL,) AND NOTHING ELSE. You should, by turning the one tuning control, be able to get stations readily within a thousand miles radius, without any "maybe," and without freak conditions. IN OTHER WORDS, THE SINGLE DIAL SHOULD TAKE CARE OF EVERYTHING. This is the ideal that Mr. Hugo Gernsback has set in many of his writings and editorials for the past five years.

In the October issue, Mr. Gernsback described the *Balanced Interflex,* which was the FIRST multiple tube set with but a single control. Good as this set is, which is best proved by literally thousands of letters that are coming in to us now, a still better set is now promised to the radio fan who builds his own. THE REGENERATIVE INTERFLEX is such a big thing that we wish to herald it to you now in advance.

Mr. Gernsback has been working on this set all summer long, and has now designed a regenerative receiver that has a fixed tickler of an entirely new kind, which, once adjusted, need not be touched any more over the entire broadcast range—something which has never been accomplished before. In order to do this, a new instrument had to be designed, which is very simple and which can be readily made by anyone. Mr. Gernsback has termed this the *Flexo-Coupler.* It does a variety of things that the usual variocoupler does not accomplish.

Moreover, the particular set in which this coupler is incorporated can be BALANCED TO YOUR LOCAL CONDITIONS, whatever they may be, so that the set will work at its highest efficiency, an accomplishment which was not possible before. So efficient is this new circuit that a one-tube set will work your loud speaker on local stations at a fair volume, while with the 3-tube set also described in the December issue, it is possible to receive stations as far as 1500 miles on the loud speaker under practically all conditions. The set has been tried in operation not only in New York City, but in several other cities as well, in order to make sure that it works under most adverse receiving conditions.

This particular set does not howl or squeal despite the fact that it is regenerative, another great point in its favor. Stations snap in and out with tremendous volume and, best of all, the set is highly selective and easily separates stations that are close together.

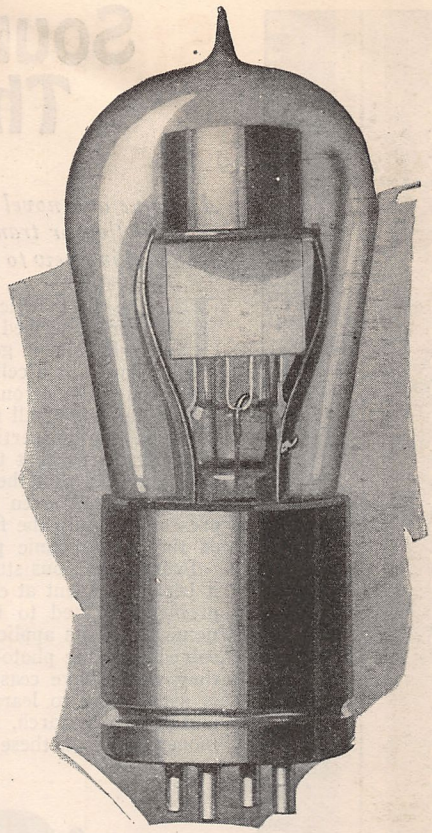
The Raytheon Rectifier

By JOSEPH RILEY

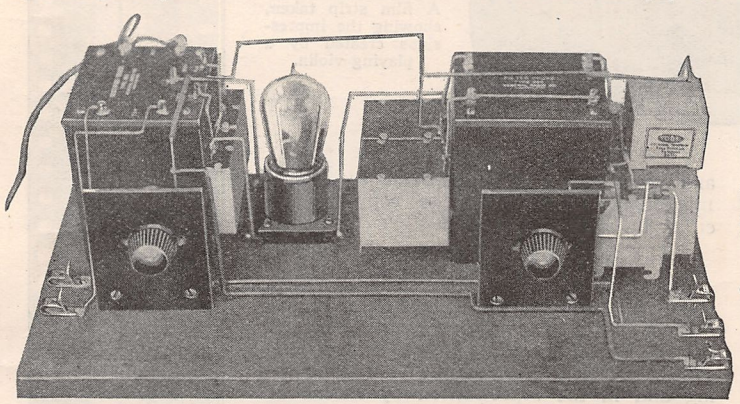
Another type of rectifier tube, filled with helium, which permits full-wave rectification with one tube.

IN THE September issue of RADIO NEWS we described a type of cold-cathode, gas-filled rectifier tube which is new to the American market. ("A New Neon-Filled Rectifier Tube." RADIO NEWS, Vol. 7, No. 3, page 293.) In that article we mentioned the fact that the neon tube was only one of a number of new devices applying well-known principles of gas conduction to the problems of radio. We propose now to describe another rectifying tube belonging in this same class, which possesses certain peculiar features and advantages. This gas rectifier promises to enjoy an extensive use in the "B" battery eliminators which so many radio users are now employing for the operation of multiple tube sets.

There are two interesting principles involved in the operation of this tube. The first, which is also the principle of the neon tube and nearly all other gas rectifiers, is the principle of the unilateral conductivity of a low-pressure gas gap between electrodes of unequal areas. The second principle is that of the existence in all gas discharges of a minimum length of electron path for the production of ionization. These statements, although formidable in sound, are quite simple in meaning, as we shall see later. In order to make this meaning clear we must study briefly what goes on in the tube in which an electric discharge is passing through a gas.



The Raytheon Rectifier.
Courtesy the American Appliance Co.

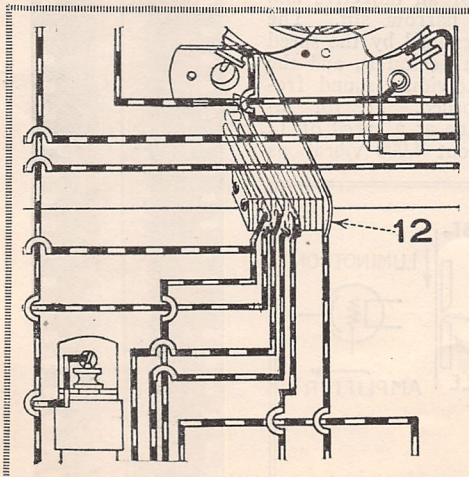


A sucessful "B" battery eliminator comprising the Raytheon tube and associated filter circuits.

Let us suppose that we have a cylindrical tube like that shown, containing two metal disc electrodes one inch in diameter and set, perhaps, one inch apart. Suppose the tube contains helium at about 1/100 normal atmospheric pressure. The general construction of the atoms of helium is known to be fairly simple. At the center of each atom is an extremely minute nucleus containing four protons, the elements of postive charge, and two electrons, the elementary units of negative charge. This nucleus has, consequently, a net positive charge of two units. Outside the nucleus are two electrons moving on paths not yet entirely determined and neutralizing the nuclear charge so that the whole atom is electrically neutral. This structure has a certain definite mechanical strength. If we bombard it with electron projectiles of sufficient energy (see Professor Bazzoni's article on "Hard Tubes and Soft Tubes as Amplifiers and Detectors", RADIO NEWS for October, 1925) we can knock off one or both of the outer electrons. It is found that an electron projectile which has fallen through a potential drop of about 25 volts can just knock off one of the electrons from a helium atom. The atom, having lost an electron, is said to be *ionized*. It has been converted into two ions, one negative, the separated electron, and the other positive, the residue of the atom.

Now the conduction of electricity through a gas depends on this *ionization*. If the gas is not ionized it acts as an excellent insulator, but when ionized it is a first-class conductor. It is very easy to see how conduction takes place through an ionized gas. If the plates A and B are charged positively and negatively, respectively, and ions are formed in the gap between them, the plus ions will be drawn to B and the negative ions to A and thus a charge will be transferred from one side to the other—that is, current will flow across. On the other hand, in the absence of ions, it is impossible for any charge to pass. We see, therefore, that ionization of the gas in a circuit gap is an absolutely necessary prerequisite to conduction of electricity across the gap. This necessary preliminary ionization can be brought about in a number of different ways, as, for example, by passing a beam of X-rays or gamma rays through the gap, or by the simpler method of merely applying a fairly high potential to the plates. Ionization in this last case develops because there are always a few stray ions to begin with, wandering around in the gas. Some scientists claim that these few stray ions are produced by radio-active emanations—like gamma rays—from the earth, but, however that may be, the fact is that a few ions are always there. These stray ions, rushing across to the oppositely charged plates when the potential is applied to the tube, serve as the electron projectiles which, knocking a few atoms into ions, start the discharge. Once the ionization is started there will be, of course, a great multitude of new ions formed by collision to maintain the flow. In the helium tube of Fig. 5 a potential of from 30 to 40 volts will thus produce a flow of several hundred milliamperes across the gap.

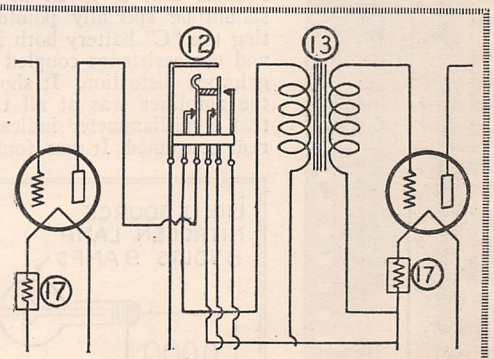
(*Continued on page* 744)



THE BALANCED INTERFLEX CIRCUIT

In the article entitled the BALANCED INTERFLEX FOUR, described by its inventor, Mr. Hugo Gernsback, in the October RADIO NEWS, page 442, a mistake in drafting was inadvertently allowed to go through. This mistake, though annoying, will cause no damage, and can easily be corrected. The diagram shown here is the correct one, the arrow pointing to the jack marked "12" indicating where the error occurred. The correction involves merely interchanging the plate and transformer leads (the two bottom prongs) on the jack.

To facilitate the use of the full-page layout and the wiring diagram of this circuit, shown on pages 442 and 443 of the October RADIO NEWS, the small sketches of this jack, shown here, may be cut out and pasted over their proper places in the diagrams on those pages.



Sound Photographs and Their Reproduction

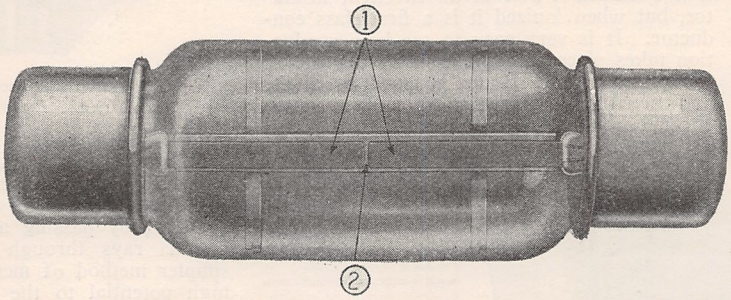
By THEODORE H. NAKKEN

A unique and novel system of recording sounds on photographic film for subsequent reproduction or transmission by radio. The Gehrke tube used in these experiments is something new to the general reader but has been used successfully by investigators.

IN the first article of this series the author described some of the photo-electric cells in general use, and in particular such a cell of his own invention, called the Luminotron.

It seems not at all necessary to dwell any more on the properties of this cell—be it sufficient to say that the cell is of the alkaline type, and that the photo-electric current is not utilized, even if such a current be present, but only the fluctuations of potential of the photo-actinic plate.

From a previous study of the bibliography it became evident at once that if the various problems related to the photo-electric phenomena and its applications could have been solved with the photo-electric cells available, they would have ceased to be problems. It is astonishing to learn the amount of labor and patient research, inventive ingenuity and money spent on these problems. Therefore, the author decided, that if all these carefully worked out schemes remained rank failures, there could be but one reason for this failure: the photo-electric cell. And this was the reason that the cell was made the nucleus of all experiments to follow.



The Gehrke tube used in making these experiments. Sides: A film strip taken, showing the impressions created by a playing violin.

PROBLEM OF AMPLIFICATION

The question of amplification is of great importance, and had to be solved before any other work could be taken on. Various experiments were made with different systems and it was found that resistance coupled vacuum tube amplification promised the best results but too many steps were necessary for good volume. Therefore, a compromise was made and the final equipment consisted of two stages of transformer coupled amplification and two stages of resistance coupled amplification. The complete diagram of this unit is given in Fig. 1, where it should be specially pointed out that omitting the "C" battery both in the transformer and the resistance coupled stages resulted in grievous distortion. It should be stated that the amplifier was at all times so connected that a milliammeter indicated the plate current consumed. It was found that the easiest way of keeping the quality at its highest point was to adjust the "C" battery potential till the plate current remained steady. When this condition had been attained, there would be movements of the meter pointer only when the amplifier blasted, and this was always due to some other reason than pure amplification. The most important part in the construction of this unit was the complete shielding of stages and of the whole amplifier, as otherwise extraneous noises and alternating current hum would drown out all other sounds. Another important consideration for clarity is the use of very large coupling condensers in the resistance coupled stages. The condensers in the amplifier sketched were two microfarads each.

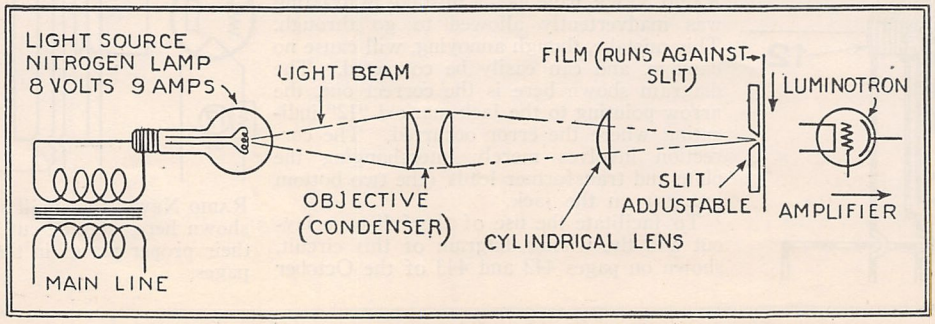
It was perceived that there are two applications of photo-electric cells which are of the greatest importance: The recording and reproducing of sound, and the transmission of photographs or copy matter, either by wire or radio.

RECORDING

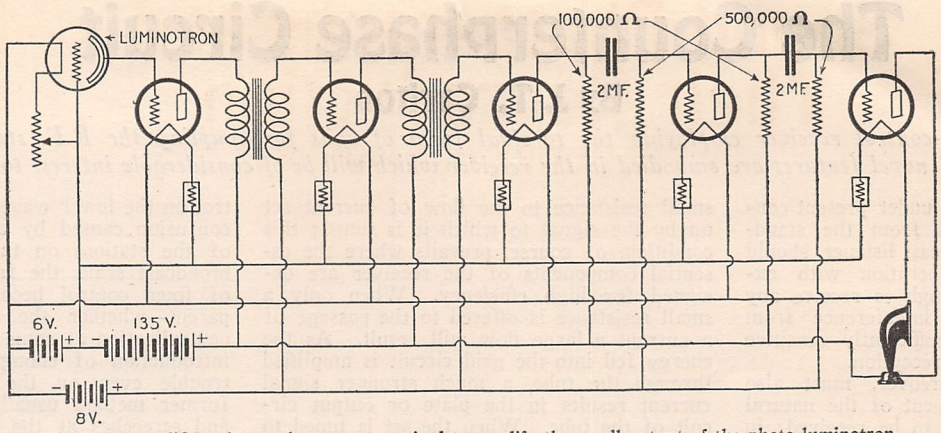
The first problem to be attacked, however, was the talking and musical film. In other words, how to record sound by photographic means in such a way that minimum distortion occurs both in the actual recording and in the reproduction by means of photo-electric cells.

It is easily understood that the reproduction of a photographic sound record is a simple matter once the photo-electric cell and the amplifier are in working order. In Fig. 2 is given a schematic representation of the arrangement generally used for this purpose.

The light from a strong electric lamp is concentrated by means of an objective and projected upon a very narrow slit. The width of this slit is determined by the speed at which the film is run behind it, and the maximum number of individual sound frequencies originally recorded. If, for instance, the film were made at a speed of 12 inches a second, and about 4,000 vibrations

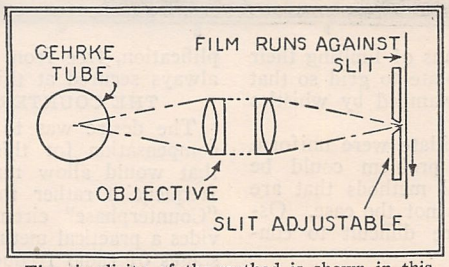


The optical system used in these experiments and the source of light for illuminating the luminatron.



A special amplifier, shown above, was required to amplify the small output of the photo luminotron. Tube noises and distortion must be kept off the system.

were the highest frequency registered on the film, the slit could have a width of about 1/500 of an inch. In this manner a small amount of light will fall through the slit and through the film, which runs directly behind this slit, and the light, after passing through the film, will then be modulated in accordance with what was recorded on the film. This light is allowed to fall upon the photo-electric cell and acts upon it, giving rise to current fluctuations. These fluctuations are amplified and used to actuate a loud speaker. The more natural the record, and the more accurately the cell reproduces the light fluctuations, and the more distortionless the amplifier functions, the more natural will be the reproduction by the loud speaker. Thus it is seen that the success of the film depends first upon the recording, second on the reproducing apparatus.



The simplicity of the method is shown in this schematic drawing.

The first thing encountered in the recording of the sound is the conversion of the sound waves into some other form of energy —preferably electric current vibrations.

After this conversion of the sound waves into microphone currents, we shall, in all probability, feel the necessity for amplifiers for these minute currents, if the sound to be registered is to arrive from a certain distance, and is not projected directly into the microphone.

LIGHT VARIATION

We shall then use the original sound-waves, or their electrical equivalent, either directly or after amplification, to vary the amount of light falling upon a registering film through the same kind of narrow slit as described in the reproducing process. In this respect there are several ways open. One of the simplest methods is to use a mirror in such a way that a greater or smaller amount of light from a steady light source reaches the film. One has only to imagine a small, light mirror stuck on the diaphragm of a loud speaker telephone or fastened to the string of an Einthoven galvanometer in a suitable manner, or again one can use the string of such a galvanometer as a sort of photographic shutter, etc. It will be clear that there is an abundance of ways of using electro-mechanical means for this manner of sound recording, and all of them can be made extremely successful, because reproduction has to be done with an ordinary loud speaker.

Under present conditions it is extremely easy to make sound records this way. We only have to select one of the programs daily in the air and, instead of receiving it on the loud speaker, the signal received can be used to record the sound by means of simple apparatus indicated above. After such a record has been developed, it can be run off again and again, and be reproduced by means of a photo-electric cell and amplified by the audio stages of a radio set.

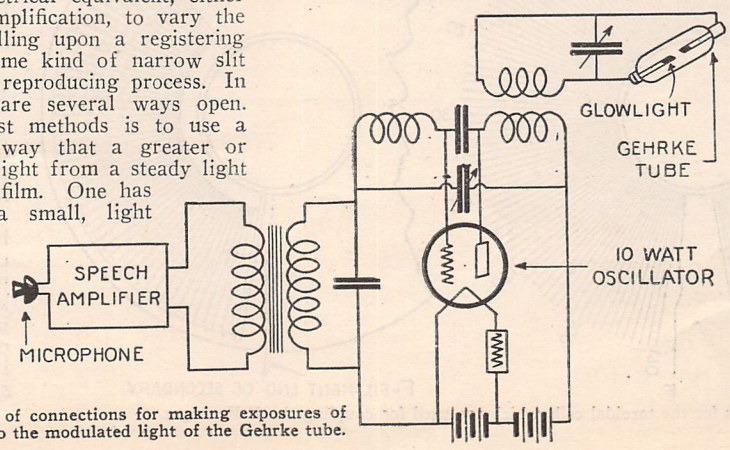
An entirely different way of recording sound photographically is the use of the currents representing the sound waves to vary the light source itself. In this connection it may be stated that the phonograph of the future will be an instrument utilizing films as records, and the quality of reproduction will be almost, if not completely, perfect. As will be shown later, there is but one appliance which must be mechanical now, the loud speaker.

USE OF INCANDESCENT FILAMENT

In attempting to modulate the light source itself by means of the sound currents it seems but natural that inventors turned to an incandescent filament, which was caused to glow more or less brightly as varying currents flowed through it. It seems that almost no inventor working on the subject of sound photography could resist this apparently easy and plausible solution. It would be possible to name about a dozen or more inventors who have secured patents on a bulb containing a fine filament, the luminosity of which would be caused to vary by speech or sound currents. The de-

(*Continued on page 722*)

Examples of the strips taken by this method are shown at the sides of these pages. The strips are records of a violin.



The complete diagram of connections for making exposures of the photographic film to the modulated light of the Gehrke tube.

The Counterphase Circuit

By J. T. Carlton

A two-control receiver employing the toroidal form of coils for coupling the R.F. stages. Several novel features are embodied in the receiver which will be of considerable interest to all.

THE ideal receiver, under present conditions as viewed from the standpoint of the broadcast listener, should be capable of operation with extreme ease, selective enough to receive any desired station without interference from any other station, and sufficiently sensitive to insure coast-to-coast reception.

Such a receiver, moreover, must also function without impairment of the natural qualities of the program to be received; in other words, faithful reproduction of tone quality is absolutely essential.

To appreciate the basis on which the circuit described herewith is founded it is necessary to turn back for a moment to the point in the development of radio frequency amplification where "adding a stage of radio" to a regenerative set was considered an accomplishment. Greater range became possible because of the fact that signals primarily too weak to register an effect on the detector tube were strengthened sufficiently for detection.

Adding more and more stages became the immediate aspiration of the multitude. Commercial refinements were rapidly introduced, resulting in more efficient apparatus, and a consequent increase in receiver efficiency and selectivity.

WHY "FEED-BACK" CIRCUITS OSCILLATE

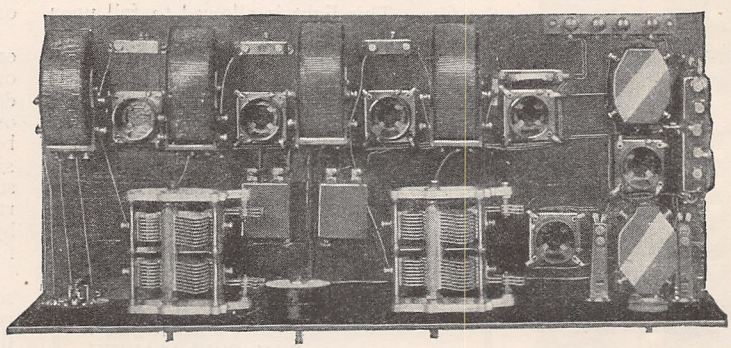
But unfortunately, as increased efficiency became manifest the difficulty that is commonly known as "oscillation" also increased in importance. It was found that within the tune of each stage of an efficient low-loss set such amplification would occur that excessive plate energy would flow to the grid of the circuit through the capacity existing between grid and plate elements. The consequence of this feeding back of excess energy was undesirable whistles and howls whenever the receiver was in reasonance or exact tune with a signal.

When in resonance with an incoming signal, the grid circuit of the tube offers but small resistance to the flow of current set up by the signal to which it is tuned; this condition, of course, prevails where the essential components of the receiver are designed for high efficiency. When only a small resistance is offered to the passage of a current a large flow will result. As the energy fed into the grid circuit is amplified through the tube, a much stronger signal current results in the plate or output circuit of the tube. When the set is tuned to resonance with the incoming signal the feedback may become excessive, and swamp the signal current. The circuit is then in an oscillatory condition—the undesirability of which is manifest through the whistles and howls that ensue.

To maintain the maximum signal current in the grid circuit we must maintain a condition of reasonance in the tuned circuit, but to allow the use of the low resistance grid circuit we must have means of limiting their energy feed-back from plate to grid so that the signal will not be swamped by whistles and howls.

If the tendency to oscillate were uniform at all frequencies the problem could be solved by any of several methods that are well known. But this is not the case. Oscillations are much more difficult to control on the lower wave-lengths, and with the confusion caused by crowding 90 per cent. of the stations on the lower half of the broadcast scale, the futility of any method of fixed control becomes immediately apparent—whether the system employed be neutralization at some mid-frequency or the introduction of enough losses to stop the trouble even on the lower waves. The former method usually results in whistles and screeches at the lower end and weak amplification at the upper, while the latter plan, although it may give favorable results on the high frequencies, usually leaves the upper end dead.

With such considerations in mind, Harry A. Bremer evolved a method of control whereby the circuit might be kept at a point just below that of oscillation at all frequencies or wave-lengths. It will be remembered that the greatest amount of amplification, free from howls and whistles, is always secured at this point.



Photograph showing the arrangement of the apparatus in the Counterphase receiver. Note the position of the tandem condensers and the toroidal coils.

Photo courtesy of Bremer-Tully Mfg. Co.

THE COUNTERPHASE CIRCUIT

The desire was to provide an adjustable compensation for this tendency to oscillate that would allow maximum results at all frequencies rather than at only one. The "Counterphase" circuit now described provides a practical method of controlling three stages of radio frequency amplification with the same ease and efficiency as if only one or two were used.

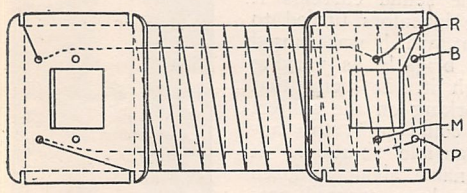
In this circuit on which patents are pending, semi-variable capacities are employed; that is, the ½ to 30 mmf. condensers are once adjusted and remain fixed thereafter.

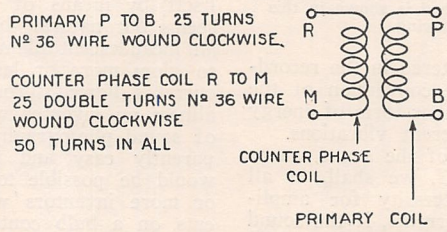
The means employed to secure the necessary variations to provide for controlling the oscillation tendency is at once new, simple and ingenious. In a condenser when the capacity is decreased the tendency to oscillate is increased. If we introduce a resistance in series with the condenser we will counteract this tendency. Each stage of amplification except the first, which is not difficult to stabilize, has its grid and plate circuits with like and reverse phase windings respectively coupled by fixed capacities in series.

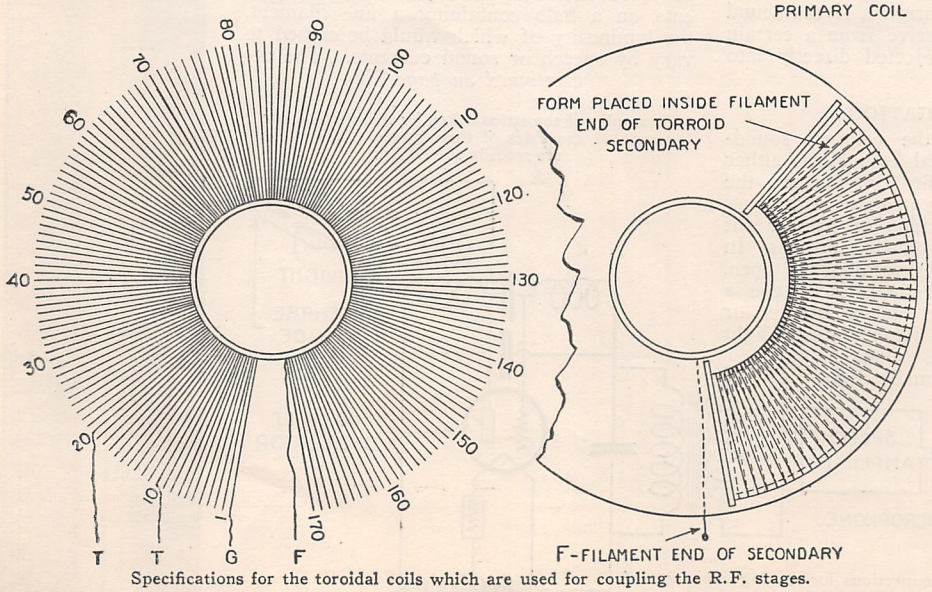
Each stage is easily adjusted so as to prevent oscillation at any frequency by varying the series resistance. Decreasing the series resistance increases the tendency to oscillate, thus governing the amount of reverse phase energy necessary to suppress oscillations at the high frequencies.

An outstanding advantage of this method lies in the fact that there is no detuning effect noticeable, as a result of which it is possible to tune three radio stages as well as the detector with but two tuning controls instead of four. Indeed, it is possible to go on adding more stages of radio frequency, if there were any practical reason for desiring to do so.

It is possible that a single control might







Specifications for the toroidal coils which are used for coupling the R.F. stages.

be used if one were satisfied to accept the approximations which must always follow when an attempt is made to combine too many functions in one unit. In the writer's opinion, no normal, two-handed person wants a radio set with only one dial to turn, and if such desire should exist it is before he has operated either kind of set rather than *afterward.*

Considered as a whole, the efficiency of the Counterphase circuit is no doubt increased because it is unnecessary to introduce any kind of losses into the grid circuit, which is thereby allowed to remain in a low resistance condition.

The plate circuit inductances are wound in reverse phase to the primary windings of the same circuit. This reverse winding is coupled to an inductance which is in like phase with the grid winding, resulting in a reverse current opposing the plate current sufficiently to retard the flow of current from plate to grid. The values of the two auxiliary inductances are sufficient to feed enough reverse phase energy for the suppression of oscillations at any frequency within the broadcasting range.

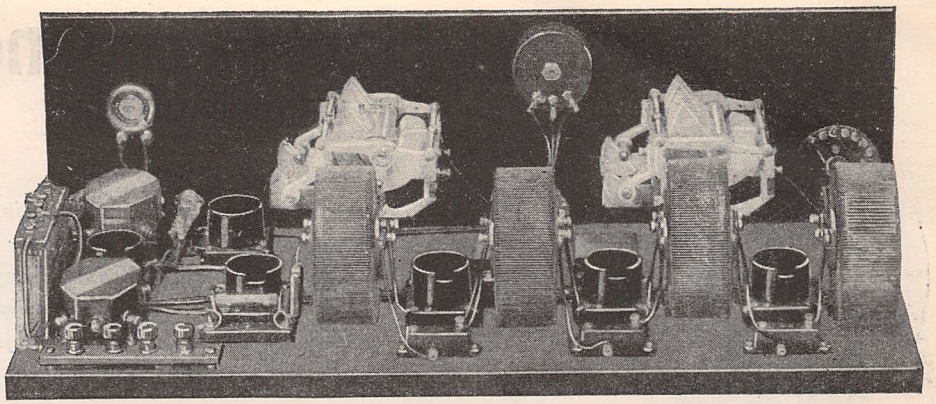
A NEW IMPROVEMENT

The variable resistance, by the way, incorporates a further new idea. It contains two separate resistance elements on the same shaft. Since sensitivity is not required on nearby stations where volume must be reduced, the balancing arm is turned to zero on resistance R-1 before resistance is cut in on R-2 to decrease volume. On the other hand, when sensitivity is required we also want volume, so that the slider arm on R-2 turns back to zero resistance before the other becomes effective. We have, therefore, three stages of radio, a detector and the customary audio stages with but two tuning dials for selecting stations and a variable resistance which needs but slight adjustment to keep the receiver at the maximum point of efficiency on all broadcast frequencies.

The use of a hard detector tube allows all six tubes to be controlled by one rheostat, and if it is desired this may be placed inside the set, as its particular adjustment may be determined without difficulty, after which it need not be disturbed.

In the schematic circuit R-1 is the resistance that controls the feed-back, and R-2 is a resistance in series with the "B" battery, the effect of which is simply to decrease potential in the same manner in which a rheostat is used in a filament circuit.

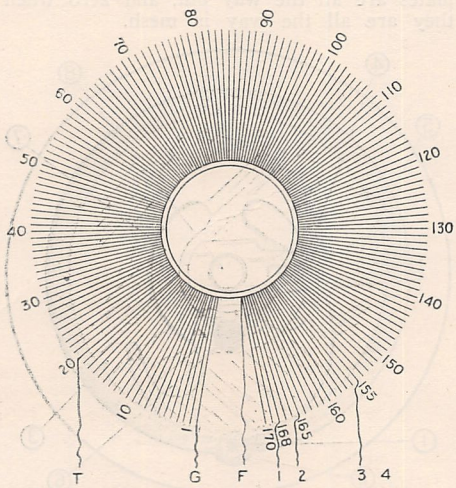
Where it is necessary in tuning to cut out resistance in order to suppress oscillations it will be readily seen that turning the knob still further results in cutting down volume, and *vice versa.* In other words, one resistance arm is always at zero when the other is in effect, and as each rotates about 270



A photo of the Counterphase which employs the circuit diagram shown below.
Photo courtesy the Bremer-Tully Mfg. Co.

there is a total of one and a half turns available between maximum sensitivity and minimum volume.

This newly designed dual resistance



NOTE: COIL TO HAVE 170 TURNS OF Nº 24 D.S.C. WIRE TO BE TAPPED AT 168-165-155-140 AND 10 TURNS FROM GRID END.
NO INSIDE COIL TAPS 1, 2, 3, 4, G, F, & T.
FOR ANTENNA COIL T A ON COUPLING COILS BETWEEN TUBES T.C.-NOT TAPPED AT 1,2,3,4, TAPPED ONLY AT T 20 TURNS FROM G.

Specifications of the toroid connected to the antenna.

serves a double purpose in that it eliminates one extra control from the panel and simplifies tuning. After the station has been selected by the two tuning dials it is only necessary to remember that the resistance knob is turned in one direction to increase sensitivity and volume and in the other direction to decrease them.

Since maximum efficiency at all wavelengths is the prime object in this circuit a further refinement is added in the tandem condensers. A small "trimming" condenser is added to each section of each tandem. One of these is adjusted and fixed so as to make its combined capacity with the main section a trifle greater than the other main unit, and then left permanently in that position.

By regulation of the second, or panel unit in parallel with the second section it is possible to adjust the capacity to secure exact reasonance between the two It is necessary to use the panel "trimmer," however, only when tuning extremely weak signals. For all ordinary tuning it is not used.

SPECIFICATIONS FOR TOROIDAL TRANSFORMERS

Secondary, or outside coil, cross section 1½ inches square, or 1¾ inches in diameter, if round; 170 turns No. 24 double-covered wire. Core 1⅜-inch tube.

Primary wound on celluloid form made to fit 120 degree inside filament end of secondary consists of 25 turns No. 36 enamelled wire, space wound.

Counterphase winding, 25 turns No. 36 enamelled wire, space wound on same form between primary turns.

Counterphase condenser 1 mmf. to 30 mmf. variable.

Tuning condensers, double units. 350 mmf., with trimmers of 25 mmf.

1 mfd. fixed capacities across "B" battery and across "C" battery.

.001 mfd. across detector plate to filament.

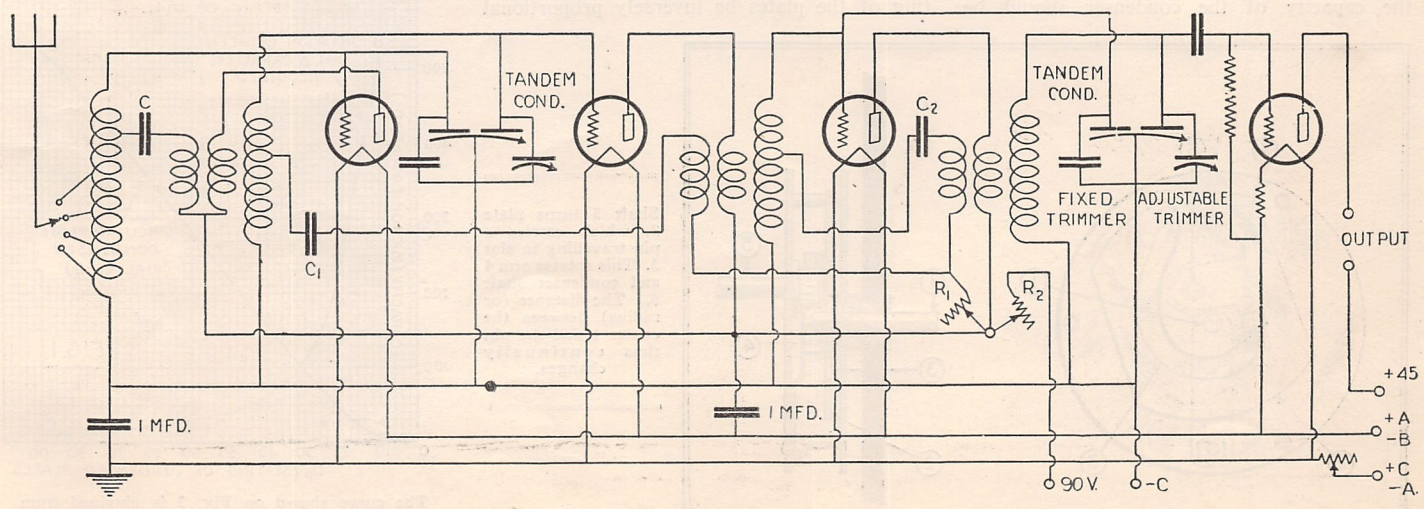
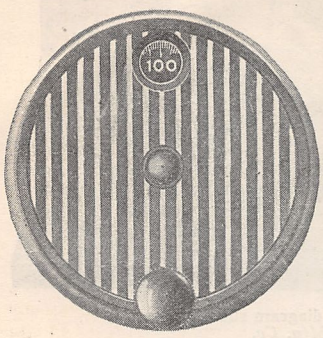


Diagram of the Counterphase circuit, showing how the tandem condensers and the toroidal coils are arranged.

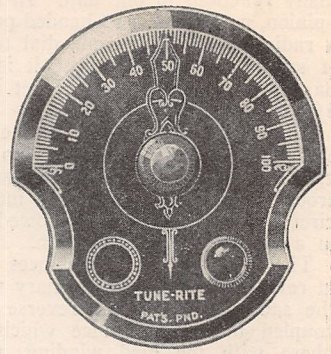
Straight-Line Frequency Dials

By SYLVAN HARRIS



Courtesy of Bruno Radio Corp.

The newest thing on the market is the straight-line frequency dial. RADIO NEWS *once again gains priority over its contemporaries in giving its readers a first-hand comprehensive view of the subject. Mr. Harris' series of articles on straight-line calibration form a complete study of the subject.*



Courtesy of Radiall Corp.

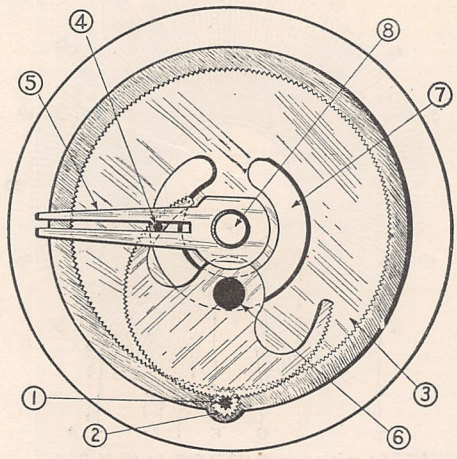
THIS season brings two great developments in radio receiver design, not in the fundamentals, but in the technique. These two developments are in the tuned circuits of the receiver, and are a result of the desire of the users, and the ambitions of the designers, to produce receivers that are more convenient to operate and less difficult to adjust.

The first of these developments, as everyone knows by this time, is the straight-line frequency condenser. This condenser has been studied in great detail in previous issues of RADIO NEWS, beginning with the August, 1925, issue. It will not be necessary, therefore, to review here the desirability and convenience of the straight-line frequency characteristic, although it may pay the reader to reread those articles and refresh his memory on the subject.

The next development—the straight-line frequency dial—is a result of recognition received by the straight-line frequency condenser, and the desire of radio users to obtain the benefits of the S.L.F. idea without going to the considerable expense of replacing the semi-circular condensers which he already had in his set with the newer type. The straight-line frequency dials are designed to rotate the plates of the semi-circular condenser in such a way that a given speed of rotation for the dial moves the condenser more swiftly on one end and more slowly on the other, so that the S.L.F. characteristics is attained.

THE LAW OF THE S. L. F. DIAL

In the previous articles I have written on the subject of straight-line frequency condensers, I have shown that, in order to obtain such a linear calibration, the capacity of the condenser must vary inversely as the square of the dial setting. In other words, if the capacity of the condenser at 100 on the dial is 0.0005 microfarad, then at 10 on the dial, the capacity of the condenser should be $(10 \div 100)^2 \times 500$ or 5 micro-microfarads. At this point it must be remembered that the dial should read 100 when the condenser plates are all the way out, and zero when they are all the way in mesh.



Pinion 2 rotates plate 3, which carries the calibration scale. Pinion 1 moves the sector about the center 6. Pin 4, fastened on sector, thus changes its radius (distance from 8) in arm 5. The smaller the radius the faster the arm (5) revolves about 8, which carries the condenser shaft.

This is the law of the straight-line frequency condenser, and the same law holds true for the straight-line frequency dial. For a semi-circular plate condenser, the capacity of the condenser is directly proportional to the angle through which the plates are turned.

Now, if the straight-line frequency law is to hold, it is necessary that the capacity C be inversely proportional to the square of the angle of the dial, which, combined with the above relation, requires that the angular setting of the plates be inversely proportional to the square of the dial setting. This, then, is the required law of the straight-line frequency dial. It will be noted that this is the same law as applies to the S.L.F. condenser.

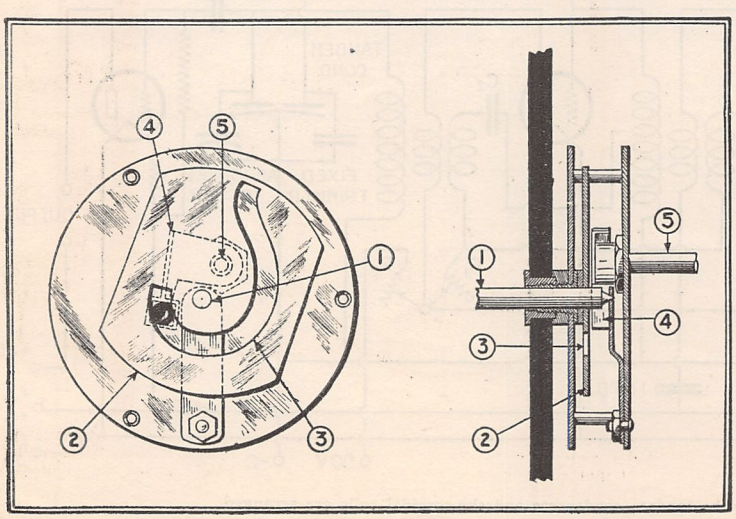
It is a rather difficult matter to deduce mathematically the shape of a cam or groove which will furnish motion to the condenser plates in accordance with the above law, as the motions in such apparatus involve both rotation and slipping, the combination of which makes the kinematical analysis difficult. Furthermore, the shape of the curve and the premises of the case depend upon the particular mechanical arrangement which is used, and obviously will be different for every individual case. There are a number of mechanical arrangements which may be used to obtain the motion required, a few of which are described in this article.

There are two particular cases in connection with the dials which are being introduced which must be carefully distinguished from one another. The reason for this is that all of them, or nearly all, will probably be called "straight-line frequency" or "S.L.F." dials. Some of the dials will be designed to furnish exactly linear calibrations (of course, forgetting the effect of circuit capacities for the moment) and others will be designed to furnish only approximately linear calibrations. This will be brought out more thoroughly as we proceed.

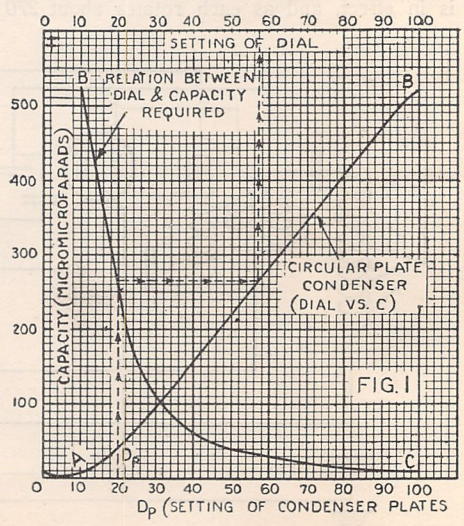
THE CONDENSER MOTION

The particular motion which is given to the condenser plates as the dial is turned is as follows:

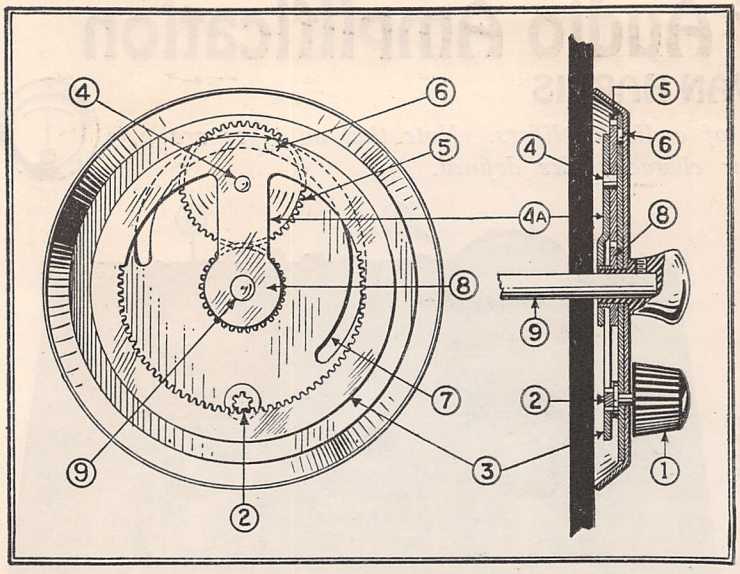
Starting at a dial setting of 100, when the plates are entirely out of mesh, as the dial is slowly turned, say from 100 to 90, the plates slowly move into mesh. As the dial is turned around further and further, all the



Shaft 5 turns plate 2, which carries a pin travelling in slot 3. This rotates arm 4 and condenser shaft 5. The distance (or radius) between the center 1 and the pin thus continually changes.



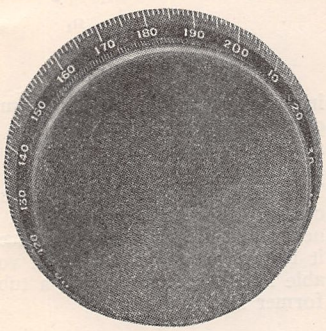
The curve shown on Fig. 3 is obtained from the capacity and frequency calibrations above, by following the path.



Knob 1 turns pinion 2, which rotates ring-gear 3. This carries pin 6 in groove 7. Gear 5 thus rotates slightly, changing the angular acceleration of arm 4 (a), which turns the condenser shaft at 9.

time at the same rate, the condenser plates rotate into mesh at a greater and greater rate.

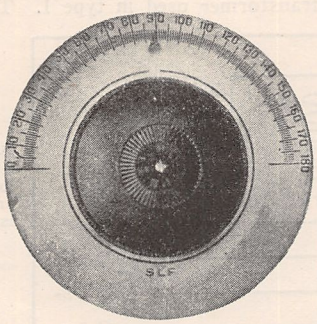
The motion of the plates with respect to the motion of the dial may be studied from the curves of Figs. 1 and 2. In Fig. 1, the axis at the bottom represents the setting of the plates of the condenser, that is, as if an ordinary dial were used. In other words, the bottom axis may be taken as representing the angle of motion of the condenser plates. The axis at the left (vertical) represents the



Courtesy of Rathbun Mfg. Co.

capacity of the condenser at any setting of the plates.

On this graph, the curve AB is the usual straight-line graph of capacity against the angular setting of the plates. Everyone is familiar with this curve; because it is linear, the condenser is called a straight-line capacity condenser. The curve BC, on the other hand, gives the values of capacity that *are required* to make the condenser give a straight-line (or linear) calibration of *frequency* against dial setting. This has been computed from



Courtesy of Walbert Mfg. Co.

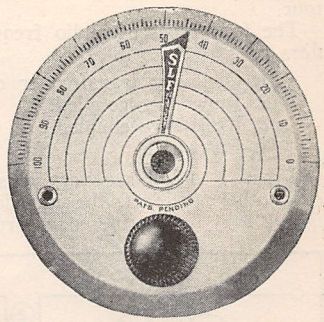
the inverse square law, which applies to S.L.F. condensers. The first ten divisions on the dial have been neglected, since, if D is zero, C become infinite. This matter has been explained in detail in the August issue of Radio News, in my first article on the straight-line condensers.

It is easy to determine from these two curves the relation between the angular setting of the condenser plates and the dial reading of the S.L.F. dial. Simply follow the path indicated by the broken lines and the arrows. For instance, if Dp, the setting of the plates, is 20, the setting of the S.L.F. dial will have to be 37, as indicated on the horizontal axis at the top of the graph. If this procedure is followed out point for point, a curve, as shown in Fig. 2, will result. The horizontal axis gives the angular settings of the condenser plates, and the vertical axis gives the dial settings.

This curve is very close to the inverse square law curve, which was deduced above. The only variations are near the ends of the curve, which are caused by the curved portions of the curve AB in Fig. 1.

THE PURPOSE OF THE S. L. F. DIAL

Before going into the various mechanisms that will give the required motion of the plates, it may be well to clear up a little misunderstanding that has come to my notice. A correspondent belittled the S.L.F. dial on the score that near one end of the motion

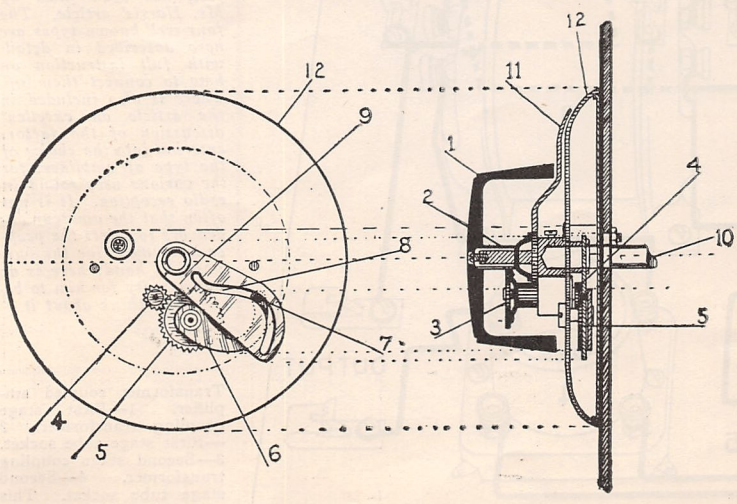


Courtesy of Big Three Radio Corp.

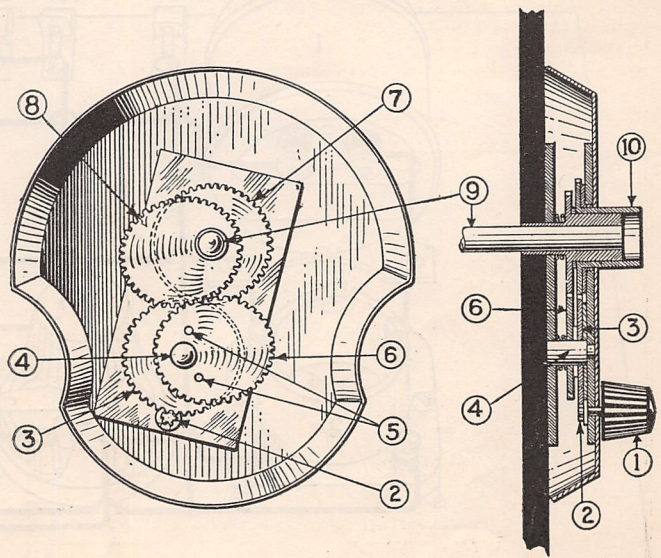
the effect was merely the same as could be obtained with any so-called vernier dial, and for that reason he might just as well use the vernier dial. What he says is true, as far as concerns the separating of stations on the dial, but the same thing is true of the S.L.F. condensers with the specially shaped plates. As the plates are turned out further and further, their area becomes smaller and smaller, and the effect is the same as could be obtained by using a so-called vernier condenser, that is, a small condenser of two or three plates.

In the construction of the S.L.F. dial the mechanical principle illustrated in Fig. 3 is always employed. It is the principle of the lever, as applied to a varying radius of the path of motion of a point fastened to the

(*Continued on page* 734)



Through a vernier attachment controlled by knob 1, pinion 4 rotates gear 5 and the arm 6. The pin 7 slides in slot 8 in arm 9, which rotates the condenser at charging rates.



Pinion 2 turns circular gear 3, also turning circular gear 7, to which the dial pointer is fastened, at the same time. Elliptical gear 6 is carried ((rigidly) by 3, and rotates elliptical gear, which moves the condenser shaft, at 9, at a variable rate.

The Four Types of Audio Amplification

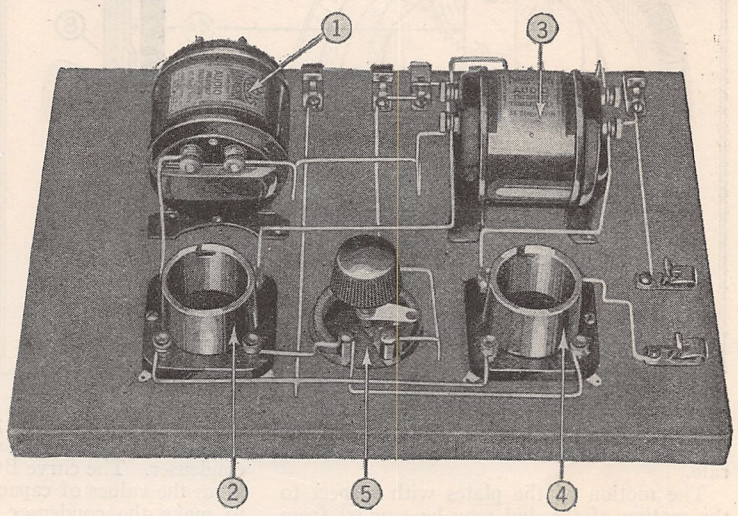
By SYLVAN HARRIS

This article is a comprehensive discussion of audio amplifiers. Note that all types are described and their characteristics defined.

THERE are, in general, four types of amplifiers, any one of which can be made to operate satisfactorily in amplifying audio frequency currents. The choice of the type to use in a radio receiver depends upon many considerations, and it cannot fairly be said that one type is better than another. This will become apparent as we proceed, and it will be seen that the different types of amplifiers are suited to different purposes. It is not well to confuse these purposes, any more than it would be well to confuse the purposes of the various types of automobiles. It would obviously not be well to put a truck adapted to heavy hauling into an automobile race, or to use a fly-weight runabout in a trans-continental tour.

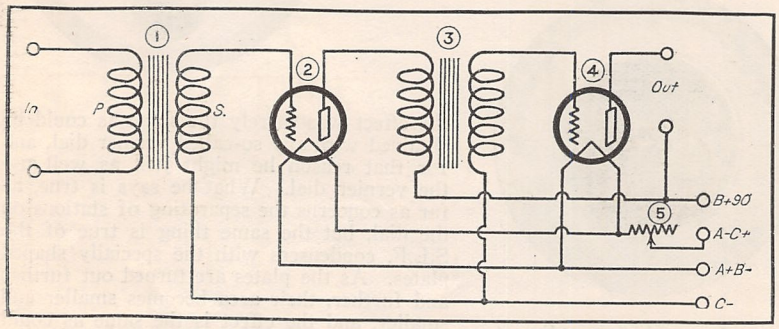
The four types of audio frequency amplifiers are:

1. Ordinary transformer coupled.
2. Impedance coupled.
3. Resistance coupled.
4. Push-pull.



The best-known type of amplifier. This amplifier uses ordinary transformers for coupling the stage.

Types 1 and 2 are very closely allied to each other; in fact, the impedance used in type 2 may be considered as ordinary transformers having two windings, in which the co-efficient of coupling is unity, and the turns ratio is also unity. The impedance acts as an auto-transformer, the same winding acting as primary and secondary at the same time.



Wiring diagram of the transformer coupled amplifier which is shown in the photo above.

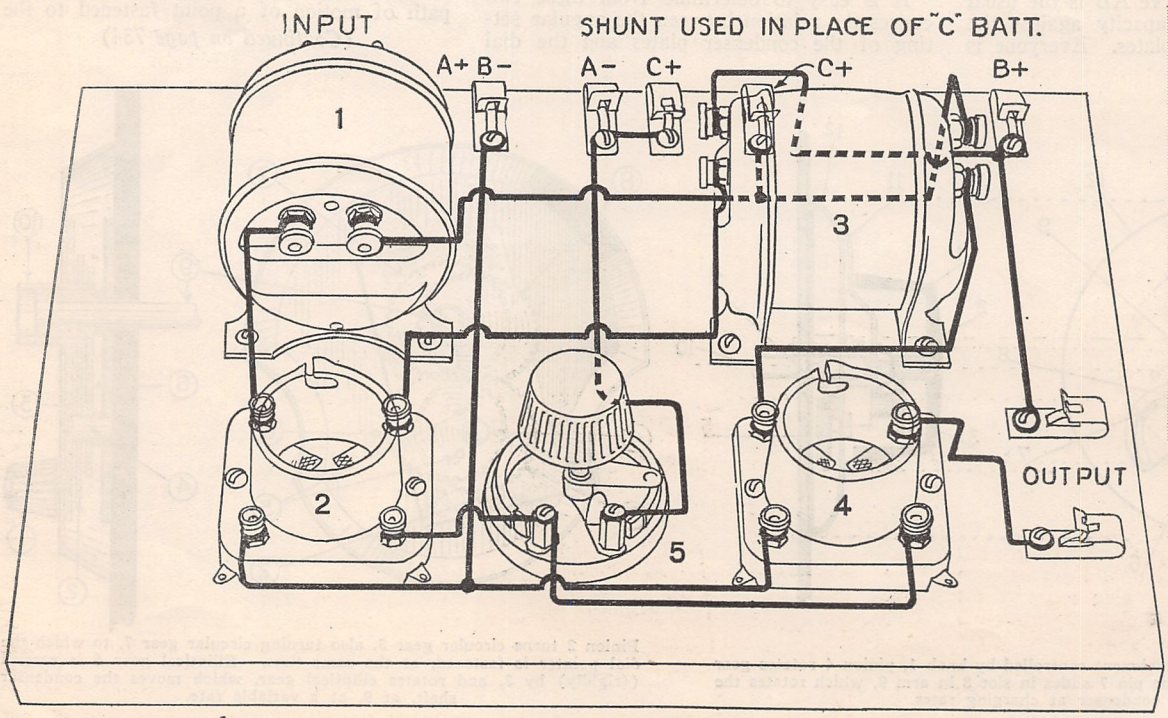
TRANSFORMER COUPLED AMPLIFICATION

Fig. 1 illustrates the use of the ordinary transformer used in type 1. The output of one tube is connected to the primary winding of the transformer, and the secondary of the transformer is connected to the input of the next tube. This is the cascade arrangement. In this arrangement, the maximum amplification per stage (that is, considering the tube and transformer as a complete unit) is equal to the amplification constant of the tube multiplied by the turns ratio of the transformer. In the transformer, as is well known, the voltage of the secondary bears the same ratio to the input or primary voltage as the number of turns in the secondary bears to the turns in the primary. That is,

$$\frac{v_1}{v_2} = \frac{n_1}{n_2}$$

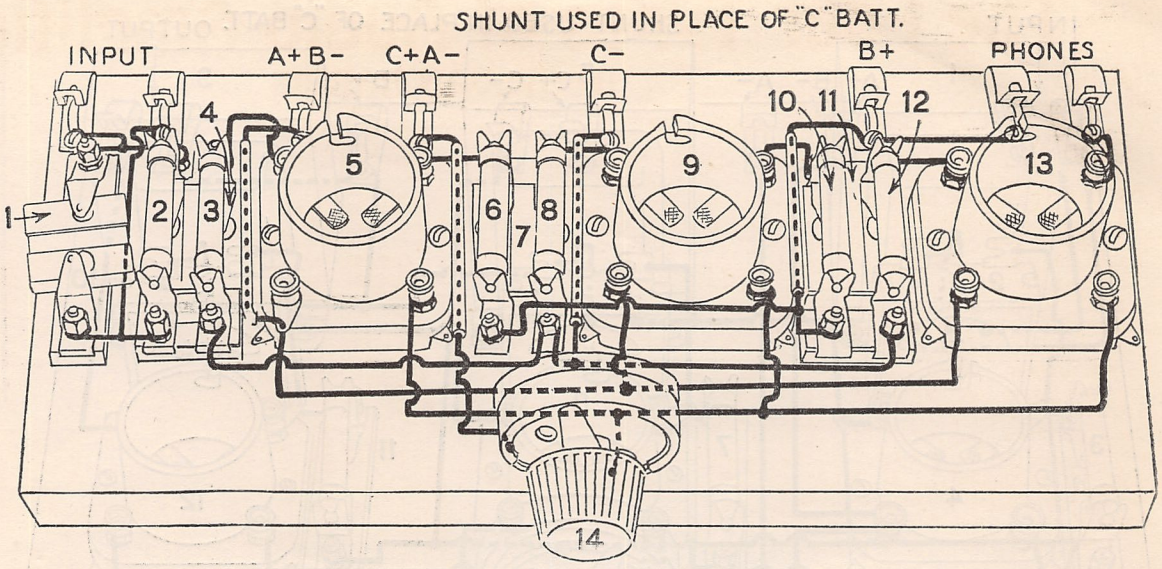
in which v_1 and v_2 are the primary and secondary voltages, and n_1 and n_2 are the primary and secondary turns. The ratio n_1/n_2 is called the turns ratio of the transformer. This step-up of voltage occurs only under certain theoretical conditions, which are never attained in actual practice. However, it follows that the maximum voltage attainable in a stage comprising a tube and transformer is

$$K = \mu \frac{n_2}{n_1}$$



Transformer coupled amplifier. 1—First stage coupling transformer. 2—First stage tube socket. 3—Second stage coupling transformer. 4—Second stage tube socket. This phantom diagram shows plainly the component parts of the amplifier and their relation to each other.

There has been a long-felt need for a general discussion of the various types of amplifiers, which, we feel, has been filled by Mr. Harris' article. The four well-known types are here described in detail with full instruction on how to connect them up. There is also included in the article an excellent discussion of the factors entering into the choice of the type of amplifier, for the various uses found in radio reception. It is not often that the amateur endeavors to select the proper instrument for the purposes at hand; here is an opportunity for him to begin to think about it.



Resistance-coupled amplifier. 3, 8, 12—first, second and third stage grid resistances. 2, 6, 10—coupling resistances of each stage. 4, 7, 11—stopping condensers. 1—by-pass condenser.

in which K is the total voltage amplification and μ is the voltage amplification constant of the tube.

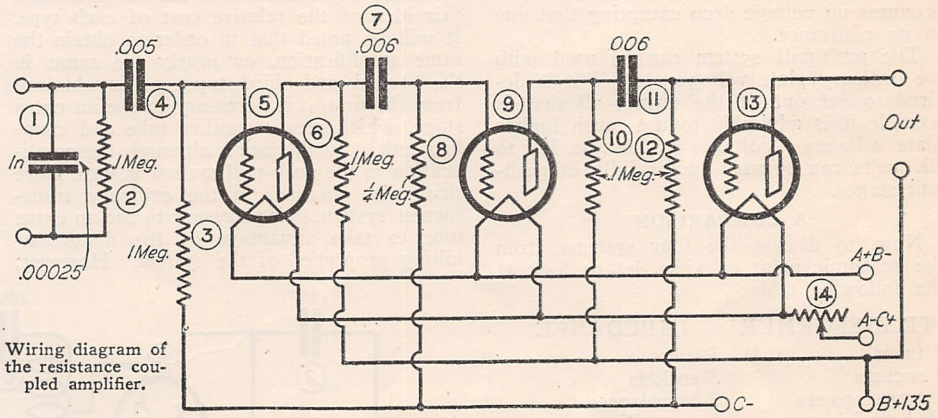
IMPEDANCE AND RESISTANCE COUPLING

The second type of amplifier is that which uses an ordinary impedance for the coupling unit between the tubes. This impedance, as explained before, acts as an auto-transformer, in which the number of turns in both primary and secondary is the same. The turns ratio in this case is unity, so that the maximum amplification obtainable when using this type of coupling with an amplifier tube is equal to the amplification constant of the tube. In other words, the ratio n_1/n_2 in the above formula is equal to one.

The third type of coupling given in the list above is the resistance coupling. It is, of course, evident that in this case there are no turns to consider, hence no turns ratio, and the maximum amplification obtainable in a stage comprising a tube and coupling resistance is equal to the amplification constant of the tube. The fundamental circuit connections for this type amplifier are shown in Fig. 3. It will be noted that in both Fig. 2 and Fig. 3 a condenser is connected to the grid of the second tube. This is a stopping condenser, to keep the high constant voltage of the "B" batteries from setting up a large grid current in the second tube.

PUSH-PULL AMPLIFICATION

The fourth type of amplifier is the push-pull. This is a system devised by the Western Electric Company for the purpose of reducing the distortion which often results from the curvature of the tube characteristics when the tubes are carrying considerable current. The fundamental circuit connections are shown in Fig. 4. This diagram shows two amplifiers connected in cascade by means of coupling transformers. The two tubes on the right, in spite of the fact that two tubes are employed, represent only one stage of amplification. Little more voltage amplification can be obtained with the push-pull arrangement than with the ordinary transformer coupled amplifier, but it will be found that a much greater plate voltage, and hence greater plate current can be handled without distortion, than can be handled by the ordinary amplifier.



Wiring diagram of the resistance coupled amplifier.

APPLICATIONS OF EACH TYPE

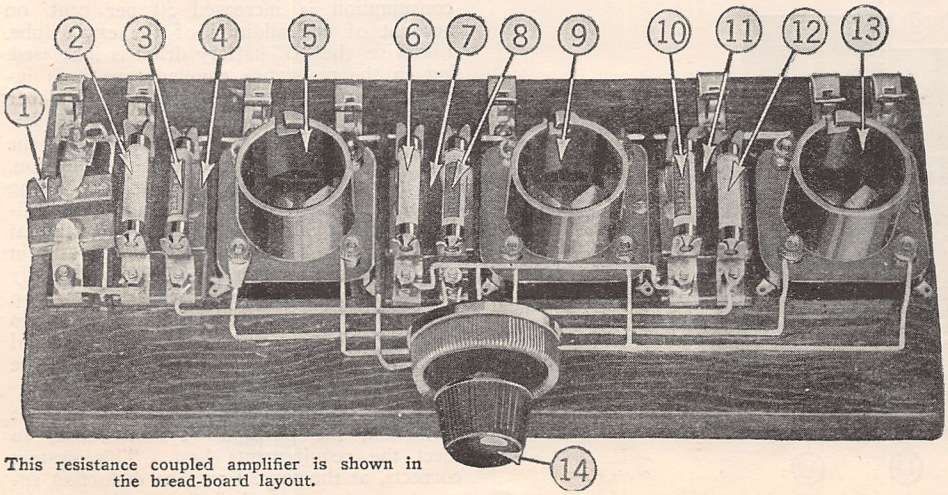
The next point to consider is the proper application of these various types of amplifiers, and their proper use in radio receivers. The most commonly used arrangement is the ordinary cascade amplifier using ordinary transformers. Very satisfactory results are obtained with these amplifiers, but in the old days, before transformers had been developed to the point they have reached today, distortion in the signals received developed quite often. This was generally due to the fact that the transformers would not produce the same amplification at all frequencies. For instance, if a violin were sounding the note C, which has a frequency of 256 per second, the amplification through the transformer would have a certain value. To reproduce all sounds faithfully, notes of all frequencies should produce the same amplification. Generally they did not, and it was found that the transformer curves were as rough as an old cobble road.

To overcome these difficulties, before any considerable improvements in transformer design had been obtained, the other types of coupling were tried. In the resistance coupling unit, due to the flow of the plate current through it, a voltage drop occurs, which, of course, reduces the effective voltage on the plate of the tube. For instance, if the voltage of the "B" battery is 150 volts, the resistance is 100,000 ohms, and there is a plate current of 1 milliampere flowing, the effective voltage on the plate is

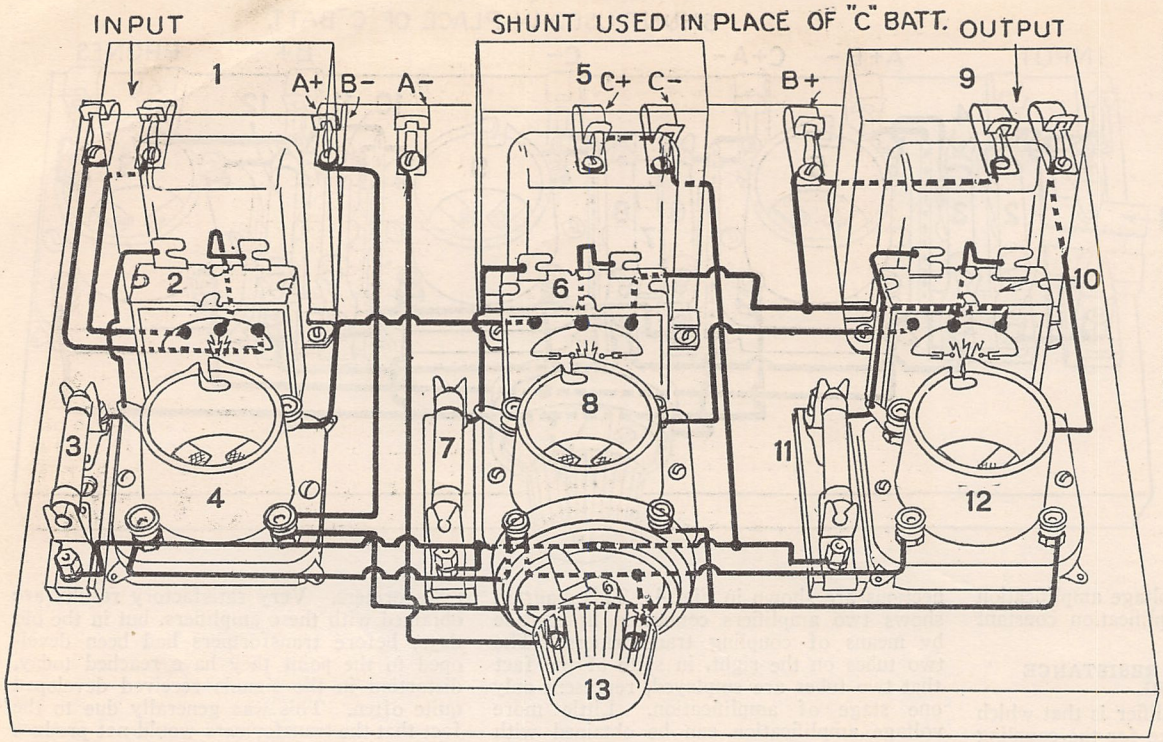
$$150 - (100{,}000 \times 0.001) \text{ or } 50 \text{ volts.}$$

The figures may vary considerably from these, but the idea is always the same. It will be noted that the effective voltage on the plate is reduced considerably because of the voltage drop in the resistance, and to make up for this effect, it is necessary to to use high values of "B" voltages.

The same ideas hold with regard to the impedance couplings, for impedances cannot be built to have large impedances, and at the same time keep the resistance low. If this could be done, the effective plate voltage



This resistance coupled amplifier is shown in the bread-board layout.



The bread-board layouts on these pages have been made because they show exactly how the amplifier will look when built into a complete set. The only difference will be found in the position of the rheostat controlling the filament current, which is generally mounted on the panel. To tell the truth, it may as well be mounted in back of the panel, for it is seldom necessary to adjust it, provided, of course, that a filament switch is included in the circuit.

1, 5, 9—autoformers, or coupling impedances. 3, 7, 11—grid resistances. 2, 6, 10—stopping condensers. This type of amplifier is coming more and more into its own as the most perfect in point of truth to the transmitted program.

would be the same as the "B" voltage, for a constant current through an inductance produces no voltage drop excepting that due to its resistance.

The push-pull system can be used with the ordinary plate voltages, but if it is desired to get out of the circuit all that is possible it is advisable to use much higher plate voltages. Voltages as high as 150 to 200 volts can be used successfully in push-pull stages.

A COMPARISON

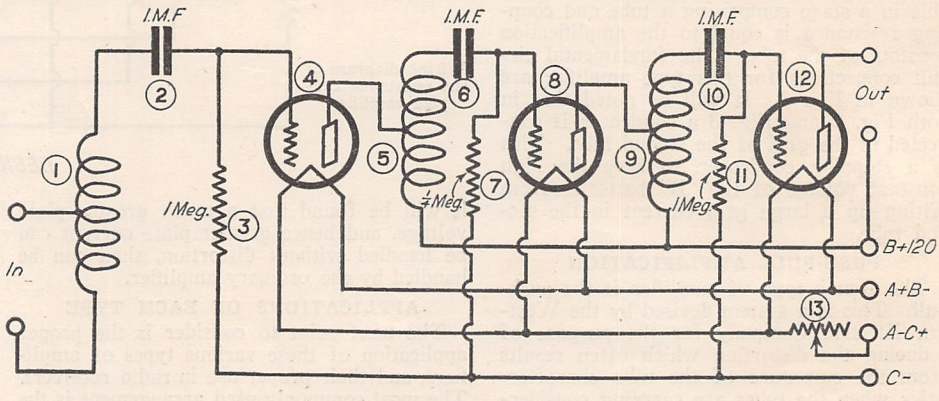
Now, to discuss the four systems from the economic point of view, let us look at the following table:

TRANSFORMER	IMPEDANCE
2 tubes	3 tubes
2 sockets	3 sockets
2 transformers	3 impedances
Ord. "B" battery	Large "B" battery
Ord. fil. current	Increased fil. current
	3 stopping cond.
RESISTANCE	**PUSH-PULL**
3 tubes	3 tubes
3 sockets	3 sockets
3 resistors	3 transformers
Large "B" battery	Large "B" battery
do.	do.
3 stopping cond.	
3 grid resistors	

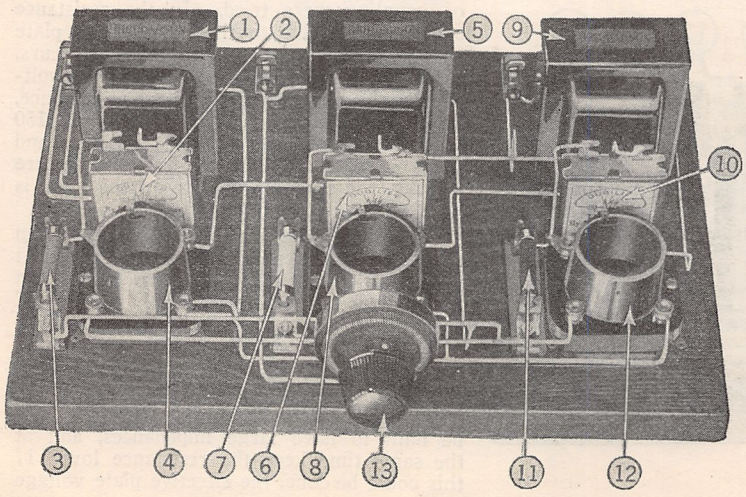
This table is for the purpose of outlining the parts required to build the various types of amplifiers, and from it can be obtained a fair idea of the relative cost of each type. It will be noted that in order to obtain the same amplification, or nearly the same, in the second and third types as is obtained from the first, it is necessary to use an extra stage, which means another tube and coupling unit. Furthermore, although the amplification in the push-pull system is little more than that obtained in the ordinary transformer system, it is necessary to use an extra tube to take advantage of the distortion-killing properties of the system. However, as has been said above, this makes it possible to use higher plates voltages without overloading the tubes.

The first three types of amplifiers eliminate the distortion which arises from the non-linear characteristics of the transformers, but allow the distortion due to curvature of the tube characteristics to remain. The last mentioned type, the push-pull, eliminates this also.

One of the main considerations in connection with amplifiers is the battery drain. In all of the types, excepting the ordinary transformer coupled amplifier, the filament consumption is increased 50 per cent. on account of the addition of the extra tube. Likewise, the "B" battery drain is increased, but in the resistance coupled type it is increased far out of proportion to the number of tubes.



AUTOFORMER



Above: Wiring diagram of the impedance coupled amplifier. To the left: photo of the impedance coupled amplifier shown in the two sketches above.

So far we have said nothing about the "C" batteries. To obtain good reproduction, it is almost always necessary to use biasing batteries in each stage. These add materially to the quality of reproduction, and at the same time contribute toward economy in reducing the plate current. This is especially true where high voltages are used, either on the grids or on the plates. In the resistance coupled amplifiers, the grid bias is obtained through the grid resistances shown in the diagrams.

Where great volume is desired without distortion, the push-pull system seems to meet the requirements best. This system corrects, at the same time, the distortion re-

sulting from the curvature of the tube characteristic and irregularity of the transformer characteristic. Full advantage of the push-pull system cannot be obtained, however, unless its load factor is kept high; use plate voltages not less than 135 volts, and have a good grid bias of about 4 to 6 volts negative.

The general construction of these four types of amplifiers is shown plainly in the various diagrams on these pages. The layout diagrams should be followed very carefully. These have been shown in "breadboard" fashion, but the assembly does not differ materially from the way in which it would really be assembled in a receiver, with the exception of the rheostats, which are generally mounted on the panel. It may be well to point out here, however, that it is not generally necessary to adjust these rheostats very much, so for the sake of simplifying the appearance of the panel, they may just as well be mounted behind it. Then, once adjusted, it will not be necessary to open the lid of the receiver and readjust them, unless the "A" battery runs pretty low. To tell the truth, it is just as convenient, in most cases, to do away with the rhostats entirely and use ballast resistances.

If an amplifier is assembled properly there should be no trouble experienced from audio frequency howling. This should be true whether the transformers are at right angles or not, for most transformers nowadays are carefully shielded in metal cases. It is well, however, to keep the radio frequency conductors well away from the audio end, as considerable trouble may be experienced from coupling the audio and the radio frequency stages. Of course, there is no radio frequency current in an audio frequency amplifier; we are referring to the high frequency amplifiers or the regenerative detector which may feed into the amplifiers.

It will be found that the push-pull system will give more volume, for a given amount of distortion, than any of the other types, but, as I have explained before, there is no economy in building a push-pull stage and then working it at a poor load-factor; that is, we should get all there is to get out of a stage of push-pull; use voltages up to 150 volts. They may, of course, be worked at the usual plate voltages, but the experimenter may be disappointed at the resulting volume when he considers that he is using another tube.

The push-pull system has much to recommend it, when properly designed and used, as can be seen from the fact that it is used in repeater stations on long distance telephone lines. It is not likely that large telephone companies would be content with inferior amplifiers.

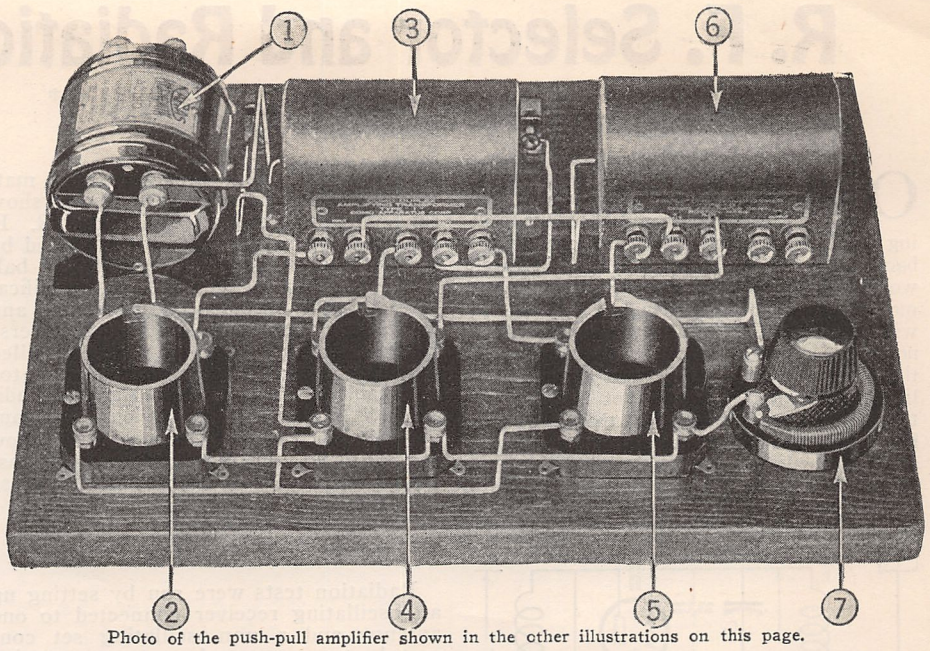
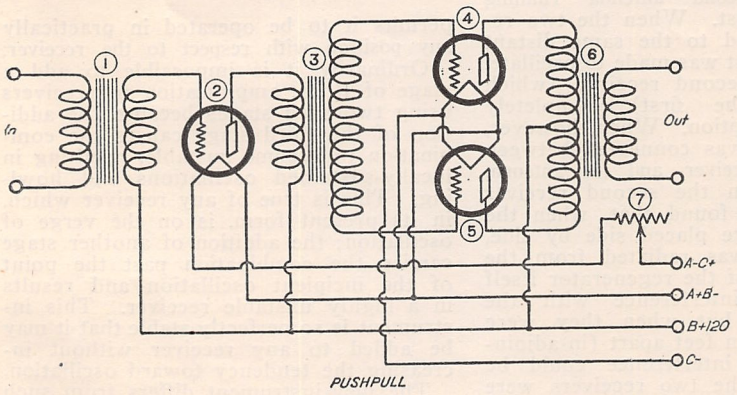


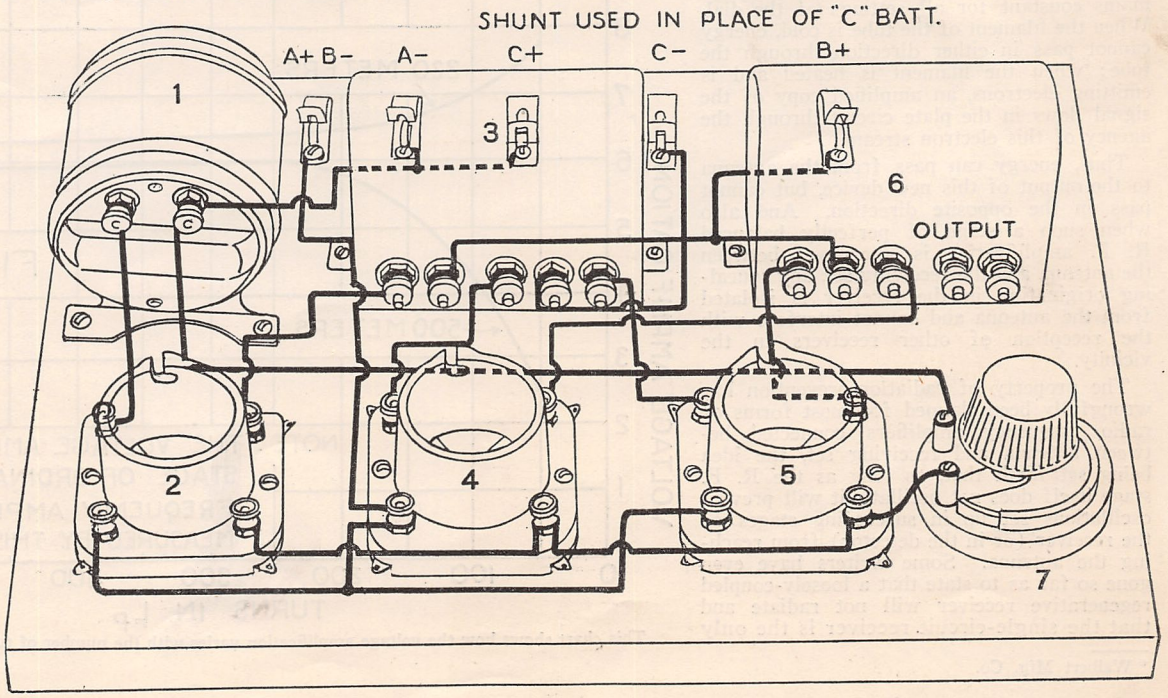
Photo of the push-pull amplifier shown in the other illustrations on this page.



Wiring diagram of the push-pull amplifier.

The resistance coupled units have also much to recommend them, for they practically entirely remove all distortion, excepting, of course, distortion resulting from curvature of the tube characteristic. The difficulty with them is that if they are not handled properly, they are likely to become expensive, in the way of running down the "B" batteries.

There is one other point that should be brought out very carefully and never forgotten. That is, that if there is distortion in the signal currents entering the amplifier, no matter what type of amplifier it may be or how good, it is not possible to obtain good reproduction. The fault here does not lie in the amplifier, but in the associated apparatus. For instance, if a regenerative detector precedes the amplifier, and regenerative is pushed too near the critical point, distortion will result and this distortion will be passed through the amplifier into the horn. When the term distortionless is applied to an amplifier, it means that it will reproduce faithfully whatever is put into it. It follows, therefore, that if a distorted signal is sent into an amplifier, it would be impossible to get out of the amplifier anything but a distorted signal.



Push-pull amplifier. 1—first stage input transformer. 3, 6—input and output transformers of push-pull stage. 4, 5—tube sockets for push-pull stage.

R. F. Selector and Radiation Preventor

By B. B. MINNIUM*

ONE of the greatest problems with which radio engineers are confronted is the prevention of radiation, or feeding radio or audio frequency oscillations back into the antenna system. Research workers have been experimenting for many months, endeavoring to find a device that will prevent radiation and at the same time not interfere with the proper functioning of the receiver. There have been circuits published heretofor that will not radiate, but there are certain types of sets that will break into oscillation at the slightest excuse and it is with the latter that engineers have concerned themselves.

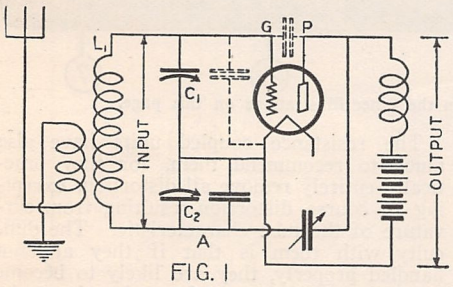


FIG. 1

The fundamental principle of this system may be easily understood with the aid of this simplified diagram.

It is easily seen that a device which will stop a regenerative set from radiating annoying squeals and at the same time will not lessen the efficiency of the set, is more or less a pretty stiff problem. Yet such a device has been developed in the form of a stage of radio frequency amplification, which is connected between the antenna and the input side of the receiver itself. The Isofarad circuit is employed in this instrument. This circuit makes the tube act as a one-way repeater so that energy can pass from antenna, or other energy collector, such as a loop, to the succeeding tubes, but cannot flow in the opposite direction. This property is due to the balance obtainable through the all-capacity bridge that is incorporated in the circuit—which balance remains constant for all settings of the dial. When the filament of the tube is cold, energy cannot pass in either direction through the tube; when the filament is heated and is emitting electrons, an amplified copy of the signal flows in the plate circuit through the agency of this electron stream.

Thus, energy can pass from the antenna to the output of this new device, but cannot pass in the opposite direction. And also when such a stage of perfectly balanced R. F. amplification is interposed between the antenna and the receiving set, any squealing originating in the receiver is isolated from the antenna and cannot interfere with the reception of other receivers in the vicinity.

The property of radiation-prevention has wrongfully been claimed for most forms of radio frequency amplifiers connected between antenna and receiving set, the idea being set forth that, as long as the R. F. stage itself does not oscillate, it will prevent oscillations set up in succeeding stages of the receiver (or in the detector) from reaching the antenna. Some writers have even gone so far as to state that a loosely-coupled regenerative receiver will not radiate and that the single-circuit receiver is the only transgressor in that direction. As a matter of fact, conclusive tests made show that all four types (oscillating R. F. amplifier, oscillating detector preceded by one or more stages of imperfectly balanced but non-oscillating R. F. amplification, single circuit regenerative, and loosely-coupled regenerative receivers) radiate strongly and that the so-called loosely-coupled three circuit regenerator is capable of causing most annoying radiation. In fact, it is obvious that any method of *coupling* which will allow energy to flow in one direction, will most certainly permit a flow in the reverse direction.

TESTS WITH THE SELECTOR

Radiation tests were run by setting up an oscillating receiver connected to one antenna and a non-oscillating set connected to a second antenna running parallel to the first. When the two receivers were tuned to the same distant station and the first was made to oscillate, howling in the second receiver (which originated in the first) completely drowned out reception. When, however, this new device was connected between the oscillating receiver and its antenna, no interference in the second receiver resulted It was found that, when the two receivers were placed side by side, enough energy was radiated from the coils and wiring of the regenerator itself to cause mild interference with the second receiver, but when they were placed about fifteen feet apart (in adjoining rooms), no interference could be heard, although the two receivers were still connected to parallel aerials. It was also found feasible to operate *two* radiating-type receivers on parallel antennae without mutual interference between them when each had been provided with the new device.

In the development of this instrument, it was noticed that the output coil of the unit was capable of radiating howls originating in the oscillating receiver circuit. For this reason the device has been completely enclosed in a sheet metal case. Incidentally, the use of such a shield

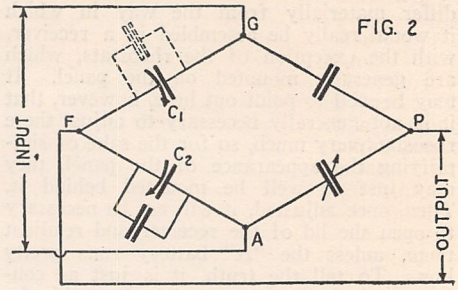


FIG. 2

The operation of the circuit depends upon the action of the bridge connection shown here.

permits it to be operated in practically any position with respect to the receiver.

Ordinarily it is impossible to add a stage of R. F. amplification to receivers using two such stages because the addition of the third stage causes the combination to become unstable, resulting in locally-sustained oscillations and howling. This is true of any receiver which, in its present form, is on the verge of oscillation; the addition of another stage carries the combination past the point of the incipient oscillation and results in a highly unstable receiver. This instrument is so perfectly stable that it may be added to any receiver without increasing the tendency toward oscillation.

The new instrument differs from such devices as the wave-trap in that a wave-trap, as usually connected, admits *all except* a narrow band of frequencies, at the same time reducing the strength of the desired signal, while this device *admits and amplifies* only the desired narrow band of frequencies.

Furthermore, such a *decided increase* in the strength of the desired signal is

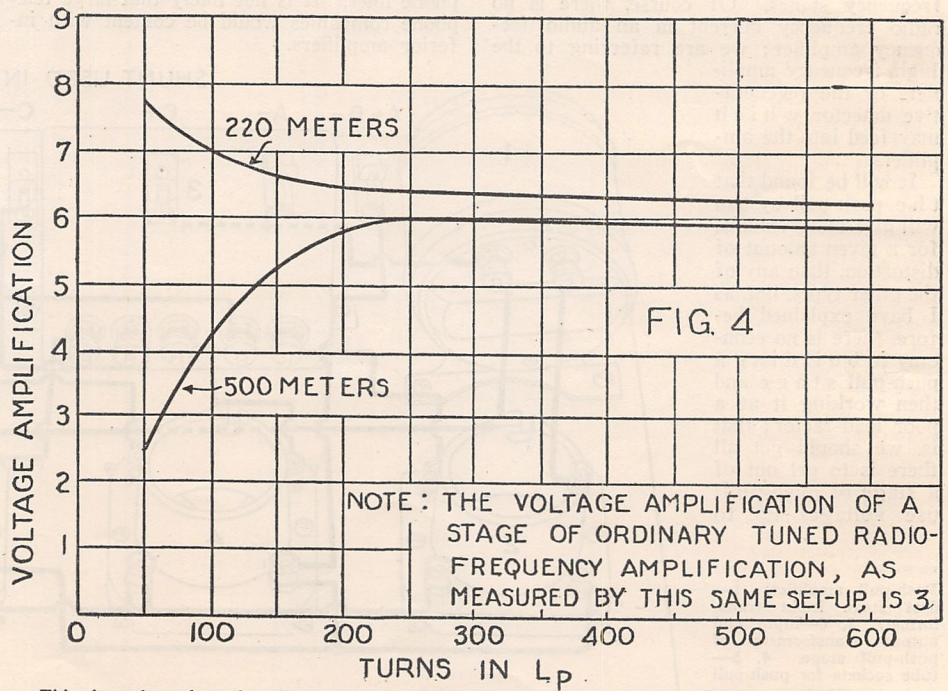


FIG. 4

This chart shows how the voltage amplification varies with the number of turns on the plate inductance.

* Walbert Mfg. Co.

obtained that, in most cases, a station which is inaudible with the receiver alone will, with the assistance of this instrument, give loud speaker volume.

Fig. 1 shows the fundamental circuit and Fig. 2 is the all-capacity bridge involved. The same lettering is used in both figures. Thus the capacity between grid and plate is indicated by the condenser between points G and P, the grid and plate respectively, of the vacuum tube; and the balancing condenser from plate to the point A is shown connected between points P and A of the bridge. This latter condenser is adjustable, but when once set at the point at which the bridge is balanced, it does not require further adjustment at any wave-length unless a tube having a different value of grid-to-plate capacity is substituted for the tube for which balance was obtained.

In Fig. 3, the input inductance L_1 is more than twice the value ordinarily employed, resulting in a very high signal voltage across its terminals—and therefore increased signal strength over that ordinarily obtained. The primary inductance is tapped as shown to allow a choice in selectivity for varying conditions of operation. Fig. 3 is the actual

This shows the arrangement of the tapped primary and the condensers.

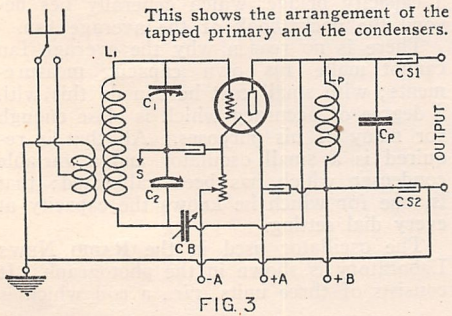
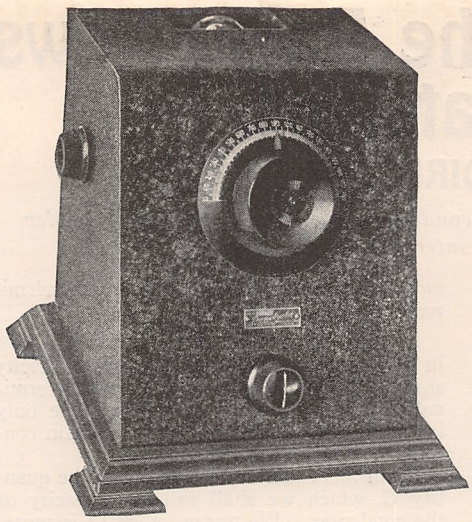


FIG. 3

circuit diagram for the type used with sets designed for antenna reception. It will be noticed that the shield marked S is not connected directly to the ground, but through a by-pass condenser. While this grounds the shield and the rotor of the twin variable condensers to alternating currents, it removes the possibility of burning out a tube by having the positive "B" battery lead accidently come in contact with the shield.



A commercial form of the instrument, known as the Penetrola.

The matter of which filament lead is grounded and which is connected to B minus lead is determined by the wiring of the receiver itself. Thus this device will function without changes in its own wiring or that of the receiver, with any set, no matter which battery lead is grounded or which is connected to the B minus terminal.

The special output circuit shown in Fig. 3 allows the unit to amplify the incoming signal when feeding into any type of receiver, whether it be of the fixed-tuned primary type (as in the neutrodyne) or a single circuit or loosely-coupled type, tuned either with a series or parallel condenser. C_P is so proportioned that, with the rest of the output circuit, it simulates the conditions of the average-sized antenna. This causes the tuning of the first dial of the receiver to be altered but very little—if at all.

The output inductance L_P has been chosen to give the highest possible average gain with various types of receivers. Fig. 4 shows two amplification curves run at 220 and at 500 meters and the inductance of L_P was chosen from the results of a series of such curves to give the maximum amplification possible.

FOR LOOP RECEPTION

For use with a set designed for loop reception, type CL has been developed. The circuit of Fig. 5 is employed. Here the loop is replaced by a very short antenna (20-50 feet long) which, it has been found by experiment, gives a better combination of selectivity and signal intensity and less static. The ground connection may be used as shown or may be replaced by a short length of wire thrown on the floor or running under the carpet. T is a small radio frequency transformer, across the secondary of which CSI is shunted in order to compensate for the difference between the distributed capacity of the secondary of T and that of the loop, thus preventing any marked disturbance in the logging of the first dial of the receiver.

In the original circuit, the condensers C_1 and C_2, which are mounted in tandem on the same shaft and are controlled by the same tuning dial, are of *equal* size. An improvement which has recently been incorporated consists in the use of *unequal* condensers for C_1 and C_2. This results in an increase in signal voltage applied to the grid of the tube of 33 1-3 per cent., as compared with the same circuit using equal capacities for C_1 and C_2.

The complete wiring diagram of the instrument.

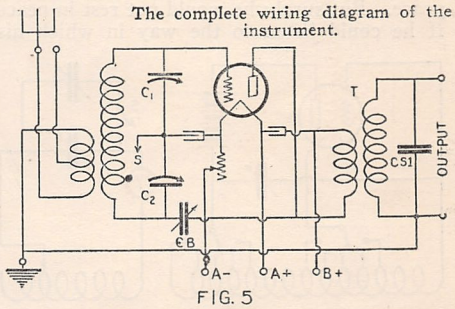


FIG. 5

The Penetrola, as this new instrument is called, requires no additional wires, batteries, or connections. It is furnished complete with three cables at the rear for connections.

Results of the Radio Shower Party

WE publish herewith a complete list of the winners of the RADIO NEWS Shower Party which was held from the RADIO NEWS Station WRNY on August 3, last.

There was an unexpectedly large response to the event, as is shown in the prize list.

Due to atmospheric conditions prevailing on the night of the shower, a great many listeners in distant parts of the country were unable to distinguish clearly the words of Mr. Hugo Gernsback, the Editor, who read the questions which the contestants were to answer. On account of this difficulty, there had to be a rearrangement of the prizes, so that those who did hear the questions and wrote the necessary explanations, fulfilling the conditions of the contest, were awarded the remaining prizes.

The prize-winning list is published below. There were entries from all over the country. However, Mr. W.C. Margaral of Bakersfield, Calif., gets the distance records. There were a number of entries from Ontario, Canada.

There is no doubt that the Shower Party was a success and it is the hope of those concerned that all contestants will be satisfied with the results and awards. The judges gave their closest attention to the matter and used every effort to see that the awards were made as fairly as possible.

Prize Winners

ZONE 1

1—Edward D. Thomas, Allston, Mass.
2—L. K. Hawkins, Augusta, Me.
3—Kenneth R. Webber, Bowdoinham, Me.
4—E. M. Spalding, Nashua, N. H.
5—S. W. Trippe, Portsmouth, N. H.
6—Grace W. Hamilton, Portsmouth, N. H.
7—Earle D. McLeod, Wentworth, N. H.
8—Maurice P. Bradford, Concord, N. H.
9—Harris R. Cushing, Plaistow, N. H.
10—Ralph W. Hamilton, Allston, Mass.
11—Edwin E. Broell, Belmont, Mass.
12—Samuel D. Robbins, Belmont, Mass.
13—D. H. Meader, Hallowell, Me.
14—Edward Govatsos, So. Boston, Mass.
15—James W. Hicks, Danville, Me.
16—J. E. Thomas, Boston, Mass.
17—Nathaniel Young, Kittery, Me.
18—Calvin L. Davis, Machias, Me.
19—Israel Cohen, Portsmouth, N. H.
20—Caleb A. Lewis, Waterville, Me.
21—Edward Etts, Rumford, Me.
22—David B. Bartlett, Dover, N. H.
23—Edwin H. Sheridan, Glencliff, N. H.
24—Howard E. Wheelock, Keene, N. H.
25—John E. Walstrom, Keene, N. H.
26—Theodore E. Sargent, Lebanon, N. H.
27—J. Edwin Gott, Manchester, N. H.
27A—Frank L. Wilson, Nashua, N. H.
28—Julia E. Sheridan, Nashua, N. H.
29—A. Maurice Wales, Penacoo, N. H.
30—P. M. Osgood, Pittsfield, N. H.
31—William Sterry, Portsmouth, N. H.
32—Geo. W. Clapp, Brattleboro, Vt.
33—Joseph C. Carter, East Corinth, Vt.
34—James C. Thomson, Middlebury, Vt.
35—John Kangas, Reading, Vt.
36—Kenneth Handley, Rutland, Vt.
37—Samuel Jones, St. Albans, Vt.
38—Frank W. Quimby, Springfield, Vt.
39—Earl C. Kelley, Underhill Center, Vt.
40—Herbert C. Leonard, Acushnet, Mass.
41—Herbert L. VanWyck, Boston, Mass.
42—John F. Barry, Brockton, Mass.
43—Chas. H. Edson, Brockton, Mass.
44—Arthur C. V. Diehl, Buzzards Bay, Mass.
45—Schuyler B. Benedict, Cambridge, Mass.
46—Walter A. Kruszyna, Chicopee Falls, Mass.
47—Ashton W. Turpin, Concord Junction, Mass.
48—Henry Greenberg, Dorchester, Mass.
49—Junius Sherman, Dorchester, Mass.
50—Herbert N. Gowell, E. Fitchburg, Mass.
51—Charles E. Kennedy, East Weymouth, Mass.
52—James C. Dooley, Fall River, Mass.
52A—G. Onson Henry, Florence, Mass.
53—Adrien Rousseau, Gardner, Mass.
54—Walter D. Meany, Gardner, Mass.
55—Harold P. Miner, Gardner, Mass.
56—Harvey M. Griffin, Gloucester, Mass.
57—Everett A. Flye, Gloucester, Mass.
58—James W. Manning, Greenfield, Mass.
59—Edmund M. Knight, Haverhill, Mass.
60—Glenn E. Adams, Haydenville, Mass.
61—Mrs. Cotton, Haverhill, Mass.
62—Chas. G. Coombs, Holyoke, Mass.
63—Henry D. Cooke, Holyoke, Mass.
64—Chas. T. Derry, Hyde Park, Mass.
65—Richard A. Hale, Jr., Lawrence, Mass.
66—Theodore B. Hathaway, Longmeadow, Mass.

ZONE 2

1—Herman Braunstein, Brooklyn, N. Y.
1A—C. W. Bossidy, Auburn, N. Y.
2—Roy Fritts, Auburn, N. Y.
3—Frank J. Lumb, Auburn, N. Y.
4—Phillip G. Shank, Auburn, N. Y.
5—C. P. Boughton, Binghamton, N. Y.

(*Continued on page 698*)

Activities of the Radio News Laboratories

By The DIRECTOR

In this article the method of testing condensers is simply explained, in order that experimenters may add this interesting test to their repertoire.

TIME was, and not so long ago, that whenever a new-born radio fan went to the local radio dealer to buy a variable condenser to put into the radio receiver he was about to build, he invariably asked for an ump-teen plate condenser. Lo, and behold, new units of capacity were brought into existence by the popularizing of radio. In the days that had gone before, engineers were wont to talk about the capacity of condensers in terms of farads or microfarads, names which paid homage to the great Michael Faraday—may he rest in peace. But surely he would not rest in peace if he could listen to the way in which his

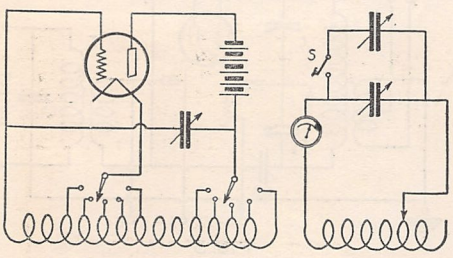


FIG. 1

On the left is the circuit diagram of the Hartley oscillator and on the right is the condenser testing circuit.

great conceptions of electrostatic capacity are ignored or misinterpreted.

Well, the point of the matter is that we should not ask an automobile dealer to show us a four-wheeled auto or the electrical dealer for a ten-pound motor. We should, most likely, get about as nearly what we wanted as we get when we ask a radio dealer for an ump-teen plate condenser.

The unit of capacity is not expressed in terms of the number of plates in the condenser. To tell the truth, it is possible to have a much larger capacity with only two plates than we can ever get in the usual 23-plate variable air condenser. Take the ordinary telephone condensers, for instance. These are made of two sheets of tinfoil separated by waxed paper, and the whole rolled up together. In spite of the fact that there are only two plates in this condenser, it may have as much as 200 times the capacity of the ordinary 23-plate variable air condenser.

WHAT CAPACITY IS

The quantity called capacity is a constant of proportionality connecting the amount of electricity held in a condenser with the voltage impressed across the condenser's terminals. In other words,

$$Q = CV$$

in which Q is the quantity of electricity stored in the condenser and V is the terminal voltage. This, of course, is true only in the perfect instrument, under certain conditions.

From this equation we can define the quantity C, which we shall call the capacity of the condenser. We agree, when Q is measured in coulombs, and V is measured in volts, to give the quantity C the name farad, after the great Michael Faraday. (We may get the idea of the coulomb by remembering that when electricity flows in a wire, the current in amperes is equal to the number of coulombs of electricity that pass a given point in one second.)

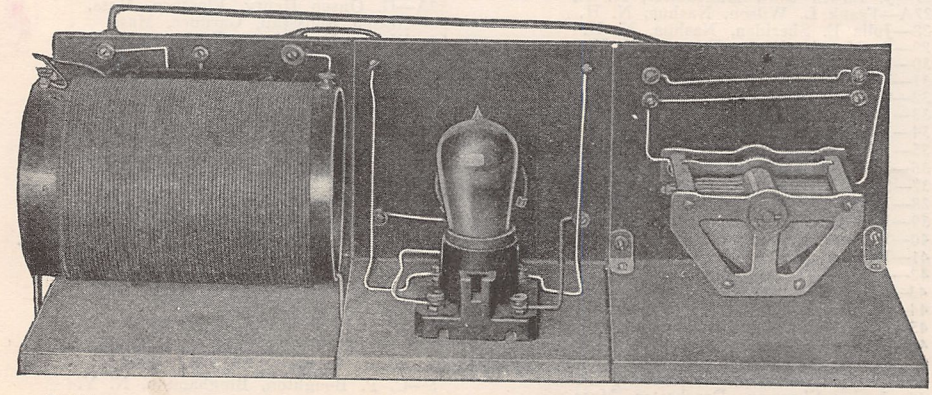
It has been found that a condenser capable of holding a charge of one coulomb under a terminal voltage of one volt would be enormous in size. This is the condition that would be required to have a capacity of 1 farad. Just think—this would be a condenser 400,000,000 times the size of our ordinary 0.00025 microfarad condenser. So, to get around the difficulty of having to deal with figures in the tenth decimal place, we have come to use, as a convenient unit of capacity, the microfarad, which is one-millionth of the farad. That is, one million microfarads are equal to one farad.

The capacity of the ideal condenser, and, for all practical purposes, the actual condenser, does not depend upon the voltage or the quantity of electricity, but upon the physical dimensions of the condenser. It depends upon the area of the plates, the number of plates, the spacing between the plates and the nature of the material between them. The formula which enables us to calculate the capacity of a parallel plate condenser is

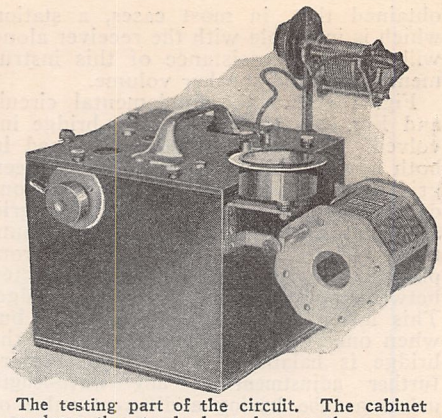
$$C = \frac{0.2246\ A\ (n-1)}{1{,}000{,}000\ d} \times K \text{ microfarads}$$

when A is in square inches, and d is in inches. K is a number which depends upon the material between the plates. K is 1 for air, 4 to 8 for mica, 4 to 10 for glass, etc. The letter n stands for the number of plates.

So we see that the capacity of a condenser depends as much upon the size and spacing of the plates as upon their number. Is it any wonder that we rarely find two 23-plate condensers, made by different manufacturers, with the same capacity? Hereafter, let us all resolve that we shall no more ask for condensers by the number of plates, but by the number of microfarads.



Oscillator used in RADIO NEWS Laboratories for the generation of frequencies covering a wave-length band from 75 to 750 meters.

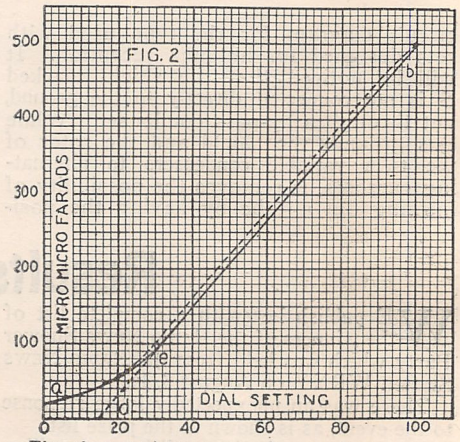


The testing part of the circuit. The cabinet encloses the standard condenser; the one on the right is under test.

We shall now see how capacity can be measured. There are many ways in which this may be done, but for our present purposes there are two methods which are most convenient. The first of these methods is by means of "substitution," which is described here, and the other is by means of a capacity bridge, which generally lies beyond the pocketbook of the average fan.

There is no reason why the average fan cannot make his own capacity measurements; with small cost he can do this with a degree of accuracy which is close enough for many of his purposes. All that is required is a small oscillator and a variable condenser which has been calibrated; that is, one for which he knows the capacity at every dial setting.

The oscillator used in the RADIO NEWS Laboratory is shown in the photograph. It consists of three units, *viz.*, a coil which is



The characteristic curve of a condenser may be obtained within a few micro-microfarads by the experimenter.

conveniently tapped, a variable condenser and a tube socket. The diagram of connections is shown in Fig. 1, and is seen to be the usual Hartley circuit. The tube used is an ordinary UV-201A or C-301A, using about 90 or 100 volts on the plate.

The coil is made of bell wire on a tube about 3½ inches in diameter. The variable condenser used has a maximum capacity of 0.001 microfarad. With about 50 turns on the coil, and locating the taps about 5 turns apart, this oscillator can be made to emit wave-lengths from about 750 to 75 meters.

This oscillator is often called the *driver*, and is used merely to supply the energy to the measuring circuit which is shown in Fig. 1. This measuring circuit consists of a coil, which may be also made of bell wire on a similar tube, having about the same number of turns as the oscillator coil. The meter shown is a thermo-galvanometer, but if one prefers this may be replaced by a thermocouple and sensitive ammeter. The

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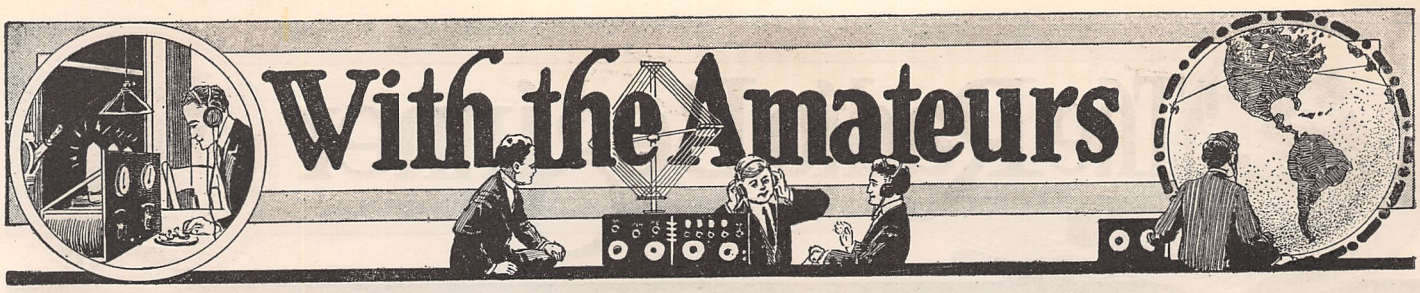

Why Run a Junk Shop?

By JOSEPH RILEY

WHY does it seem to be a general impression among those who are not actively connected with the ham radio game that every amateur station is nothing more or less than a bunch of junk thrown together in an indiscriminate manner and without the least systematic arrangement? Now gather around the table close, boys, and I'll tell you why. Because it is so! True enough, there are some good, up-to-date ham stations that look almost as though they were really constructed, but frankly these are few and far between.

The next time you sit down to pound brass, look around you. Probably you will see a tuning inductance hung upon the wall by a piece of string or lying up against the wall and using that as a support. Then you will probably see a couple of fixed condensers lying on the table a foot or so away from where they ought to be and literally tied to some other part of the circuit by a couple of hunks of magnet wire. Probably the tube is in a precarious position, directly under some heavy piece of apparatus that is likely to fall upon it, diminishing the resources contained in your pocketbook by a few odd dollars. If there is any pretense toward system at all, it is probably in the receiver. A good many hams have learned to build their receivers so that they look like a real piece of apparatus and not like a bunch of junk but—can this be said of our transmitters? No, empathically, no! In the majority of cases it cannot be said. We still persist in throwing our stuff together without seeming to worry about appearances. Everybody wants to reach out further and further and after they have reached the limit of their transmitters, to go beyond that point. As a consequence, a good many of us have forgotten that we are really sacrificing something by using these short-sighted methods.

You will probably answer this by saying that you put your stuff together that way so that you can experiment with it. Probably this is true, but it is not at all necessary for you to sacrifice the efficiency that you do by using the junk-shop method. You can do experimental work without being slipshod. Where do you think some of the big research laboratories would be if they threw their apparatus around on the table in any way it happened to fall and tied it together with magnet wire? We would all still probably be using coherers or magnetic detectors at the best. This sort of stuff won't go, fellows, and the sooner you realize it, the better off you will be. When you build a new piece of apparatus, build it right and provide it with some kind of mounting, so that it can stand on its own feet and not have to lean up against the tube or the wall. Even in making an experimental layout, place the various instruments as close to each other, and in as accessible a position, as is possible. Give a little thought to the work and it will go much more quickly and easily. Then, instead of using odds and ends of bell wire or magnet wire to hook the set up, use a few lengths of fairly heavy rubber-covered flex. You can hook up a set just as quickly this way as with the magnet wire and the results will be far superior. Suppose a couple of leads do cross each other. It will do no harm for, in almost every instance, the rubber insulation will prevent sparking. Not so with magnet wire. Trouble will be encountered, particularly if this wire is carrying radio frequency current in any appreciable quantity. I have personally seen more than one set go out of operation because of an arc formed between two unprotected leads. This is bad business for all concerned and some day may cost you an expensive piece of apparatus. Shooting a thousand volts across a pair of filament bypass condensers that are only rated at 100 volts breakdown is bad stuff. Regardless of their quality, condensers cost money and, once punctured, are worthless. Let us put condensers of this nature on one side of the financial balance and a few lengths of rubber-covered flex on the other side. Which

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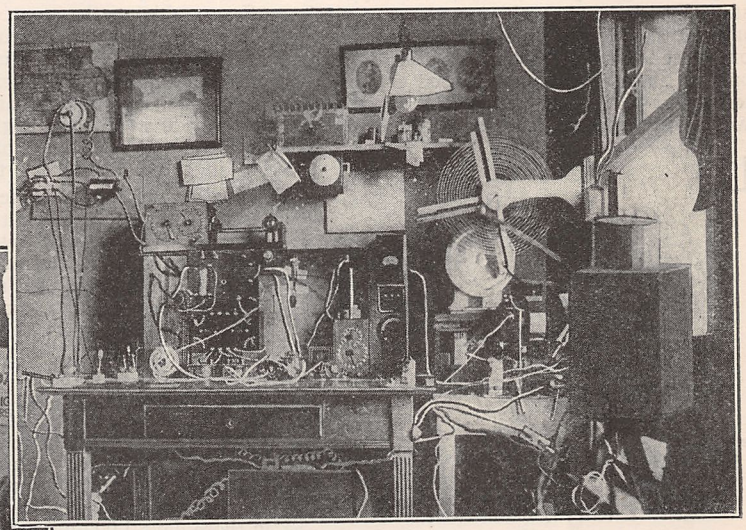
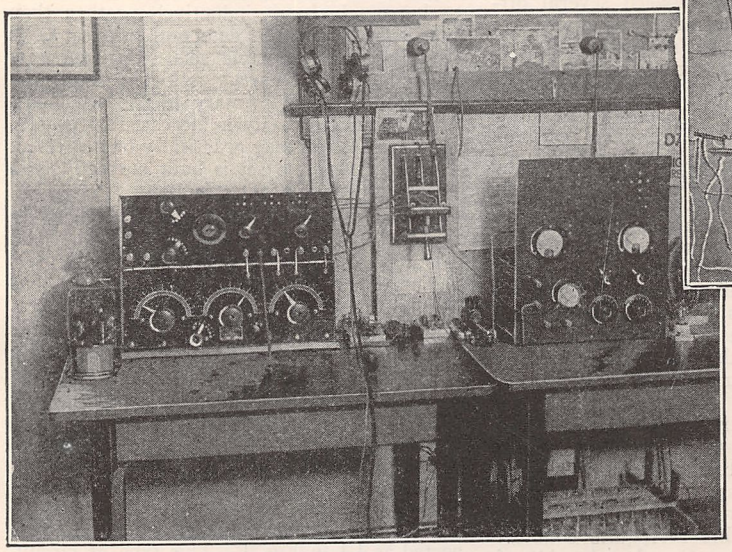
Why do this → when it is so easy and so conducive to efficiency — as well as G and F cards—to do this ↓





THE MONTH'S CROP OF NEW QRA's

2LC—William J. Rooke, 463 East 158th Street, New York City. QSL crds answd.

3HP—George E. Stewart, 220 Collins Avenue, Baltimore, Md. 5 watts C.W. All crds answd.

3PY—Reassigned to Francis Richardson, 507 South Orange Street, Media, Pa. 175, 84 and 41 meters. All crds answd.

No. 6—5 watts C.W. Crds answd same day rcd.

5AUO—Gaston Johnson, 712 East Mississippi Avenue, Ruston, La. 20 watts, fone es C.W.—150-200.

5AVC—A. E. Williams, 408 South Vienna Street, Ruston, La. 5 watts on 20, 40 and 80 meters.

5OI—Alfred Leitch, Ruston, La. 50 watts C.W.—80 meters.

5APS—W. F. Warrell, Bernice, La. 20 watts, fone es C. W.—150-200 meters.

4OY—R. O. Dorset, Spartanburg, S. C., R.F.D.

8CW—J. A. Clark, Glens Falls, N. Y. 5 watts C.W.

6BWS—Russ. Shortman, 1617 Van Buren Street, Phoenix, Ariz. QSLs answd.

9AZQ—Reassigned to F. J. Nicholas, Box 484, Savannah, Mo. QSLs quickly answd. QRK mi 10 watts?

9UI—Junior Bishop, 616 West Sixth Street, Sedalia. Mo. Pse QSL mi 20-40-80 meter sigs. QKS.

Getting the Most from Crystal Sets

By A. P. PECK

PROBABLY the most neglected part of the apparatus that will enable us to receive our daily concerts and radio entertainment is that little unit known as a crystal detector and that part of it which makes its operation possible—the crystal itself. Of course, there are many people using crystal detectors today, but statistics show that this number is much smaller than those using sets employing one or more vacuum tubes. In the writer's opinion, those who have not used crystal detectors or have not done any experimental work with crystals, have missed one of the

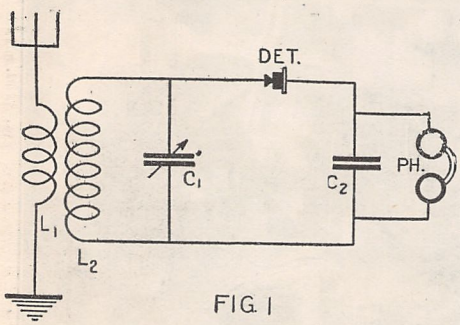


FIG. 1

A simple crystal set but one that is not very selective is shown above.

biggest and best parts of radio reception. You can get more fun out of working with various types of crystals and detectors stands at less actual expense than from any other experimental work.

ADVANTAGE OF CRYSTALS

A crystal detector has a great many advantages. First and foremost, it is inexpensive. Crystals are cheap and holders or detector stands are easy to make. There is no upkeep to a crystal detector, as no batteries are used and there is nothing to deteriorate, except possibly the crystal, which may become a little insensitive. It, however, can often be renewed by a method which we will outline in detail later on. Then again, although the range of a crystal detector receiving set is somewhat limited, still when signals are received with it, they are pure and undistorted and music and voice come through with life-like precision. Even though the reception range of a crystal detector is limited, still in this day of multitudinous broadcast stations, many of which are operating on comparatively high power, there is always at least one broadcast station within the range of a crystal set in the United States and sometimes there are many more.

In the metropolitan district many advanced fans have crystal detector receiving sets at hand with which they can listen in on the local broadcasting. From this they get much enjoyment from radio in general and at the same time practice real economy, in that they do not have to use their tube sets for local reception and thus save on "A" and "B" batteries. Crystal sets are so inexpensive to make and most fans have enough material at hand to make one without further expenditure, that the writer heartily recommends that all of the readers of this article build crystal sets of their own, so that they can come in for some of the fun that radio offers, without the consequent expense of tubes. Furthermore, if you will put a little study into the subject of crystals and if you will experiment with various types of detector stands, contacts and crystals themselves, you will derive a great deal of benefit from the work, not only in enjoyment, but in actual knowledge thus obtained.

The writer's experience with crystal detectors dates back to about 1913, when popular favor was divided between several different types of detectors. Among these were the old Marconi magnetic detector, microphonic detectors, and a few types of crystal detectors. At this time, of course, there was no broadcasting, such as we know it today, and practically the only reception possible was from amateur transmitters, ship stations and land stations. Today, if someone said that he received over a distance of 1,000 miles with a crystal detector, he might be looked upon, to say the least, as one who stretches the truth. However, in those days 1,000-mile reception from high-powered stations was by no means unusual. At the writer's home in central New Jersey he frequently heard the naval station at Key West, Fla., and at more than one time received signals from another high-powered station located at Mare Island, Calif. True, all of these stations transmitted on considerably higher power than the average broadcast station uses today, but, nevertheless, at that time the apparatus used was rather crude in form and this fact quite counterbalances the high power employed. All of the receiving apparatus that the writer used, with the exception of the head-phones, was home-made.

Although, as mentioned above, the range of a crystal detector is somewhat limited, still the intelligent use of a set embodying one of these little instruments has brought some surprising results. The writer has personally received broadcasting from station KDKA, approximately 250 miles away, and this on a home-made crystal detector employing a piece of galena. This shows that the old saying that a crystal detector could not be depended upon to receive over more than 25 miles does not always hold true. Under extraordinary conditions on one extremely clear night that was practically free from static, Atlanta, Ga., was received on the same detector. During the winter months this sort of work is not at all exceptional and we could go on to state hundreds of other cases of excellent reception with crystal detectors. However, from those facts given you can easily see that a good bit of excellent work can be done with these somewhat neglected instruments and if you will follow some of the details given below you should have no trouble in duplicating many of them

SELECTIVITY

Usually when a crystal detector set is mentioned for use in broadcast reception, somebody immediately goes up in the air and rants and raves about the non-selectivity of sets of this nature. This is an impression that should by all means be corrected. A properly designed and constructed crystal set will give quite good selectivity. Of course, you cannot expect to use a single-slide tuner or something similar to get good results.

The first thing to do toward making the crystal set selective is to couple the antenna and ground circuit inductively, rather than conductively, to the detection circuit, as is usually done in simple sets. Of course, a slight amount of energy is lost in the transference from the primary to the secondary circuit, but selectivity is increased so greatly that these losses may practically be neglected. If the rest of the set is built correctly, you need not worry about this loss.

One of the simplest types of inductively coupled sets is illustrated in Fig. 1. Coils L1 and L2 may be a standard type of tuned radio frequency amplifying transformer that can be obtained at any radio store, or you may build one yourself in the following manner: Near one end of an insulating tube 3½ or 4 inches in diameter, wind 5 or 6 turns of No. 18 or 20 D.C.C. wire. One-quarter of an inch away from this winding and on the same tube start another coil having 45 turns of the same wire. This constitutes the secondary and is connected to the variable condenser and crystal detector, as shown. The first mentioned winding is connected as L1 in Fig. 1. This type of circuit is extremely simple to control, but in con-

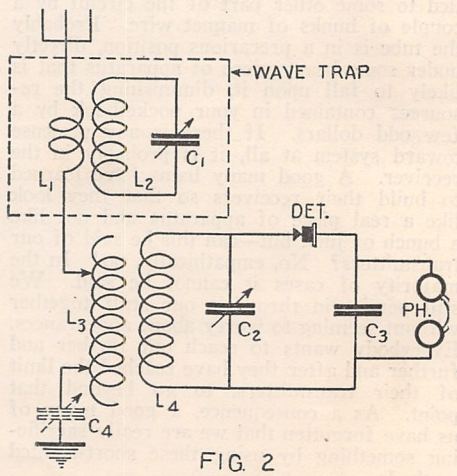


FIG. 2

A crystal set is made much more selective by the additions illustrated.

gested districts it will be found that the selectivity of it is not all that could be desired

Thus we must search a little further for a set that will give us everything that we want The first consideration is the tuning of all circuits, rather than only one. If the aerial and ground system is tuned, selectivity will be increased still further. This can be accomplished by using a variocoupler and connecting it as shown in Fig. 2. The variocoupler windings are indicated by L3 and L4 and often a series condenser, C4, will be found to be of still greater assistance. This is particularly true if the variocoupler employed is only tapped coarsely or in sections of 10 turns or so. If, on the other hand, this coil is tapped in what is known as units and tens, a variable condenser is not always necessary, but will frequently help. The only way to determine this for your own particular set or in your own particular locality is to try the set both with and without a variable condenser.

The set shown in Fig. 2, less the section labeled "wave-trap," is in itself very selective, but in some districts the stations are often crowded so close together in wavelength that two of them may interfere with each other, and with this set you may not be able to separate them satisfactorily. In this event, a wave-trap may be employed. The best one of these instruments and the one that introduces the least losses in the circuit is what is known as the inductively coupled absorption type. This has only one disadvantage and that is that it will only tune out one station at a time. On the other hand, it has one big advantage in that it seldom, if ever, affects the signal strength of the station from which the listener desires to receive.

WAVE-TRAP CONSTRUCTION

This wave-trap consists of two coils wound very much after the same manner as coils L1 and L2 in Fig. 1. If desired, however, the coil L1 may be wound directly under L2. You will note that the absorption circuit composed of coil L2 and condenser C1 is not conductively connected in the circuit in any way. The theory of this instrument is that when two stations are both being heard in the phones, one of them may be tuned out by changing the capacity of the variable condenser C1. What happens is that you tune coil L2 and the condenser C1 to the exact wave-length of the interfering station that you desire to eliminate. This circuit immediately absorbs practically all of the energy being received by the aerial from the interfering station and does not allow it to get into the set itself. Thus the station is eliminated.

A home-made wave-trap is shown in the photograph in Fig. 3. Here the tube containing coil L1 and L2 is mounted on the outside of the cabinet for the very simple reason that there was no room for it inside. You can make your own unit up to suit yourself and can place the coil either in or outside the cabinet. In any event, however, place the wave-trap unit at a short distance from the receiving set proper so that there will be no interaction between the two. This effect is not so noticeable when using a crystal detector as if the trap were used with a tube

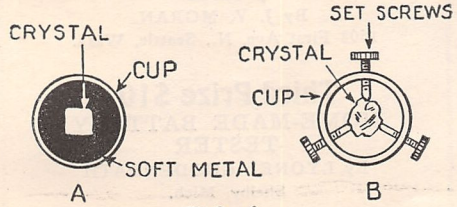


FIG. 4

A and B show two very good methods of holding crystals in cups so that good contact is made.

set, but nevertheless it is often bothersome. Probably a separation of one foot between the two units will be found sufficient.

The various constants for the circuit shown in Fig. 1 are as follows: L1 and L2 were described above and C1 has a maximum capacity of .0005 mf. and C2, a fixed capacity of .001 or .002 mf. This latter condenser will not be found critical and almost any unit that you may have on hand that is larger than .0005 mf. may be used. In Fig. 2, C1 has a capacity of .0005 mf., L1 and L2 are the same as in Fig. 1, L3 and L4 are the stator and rotor respectively of a standard variocoupler, C2 has a maximum capacity of .0005 mf., C3 is the same as C2 in Fig. 1 and C4 has a maximum capacity of .0005 mf.

In case you wish to build a variocoupler yourself to be connected as shown in L3 and L4 in Fig. 2, the following approximate dimensions may be followed. Wind L3, the stator, on a 3½ or 4-inch tube, placing 72 turns of No. 20 or 22 D.C.C. wire on it. Tap this winding every 8 turns for 8 taps and then every turn for 8 taps. The rotor L4 may be wound on a tube or an ordinary ball form that can be bought at any store

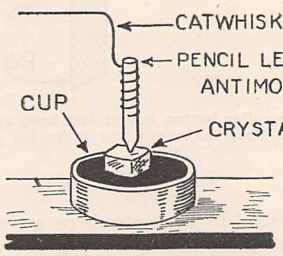


FIG. 5

A piece of pencil lead or antimony makes an excellent contact for use with galena or silicon.

and should have 40 turns of wire. It is then mounted in any suitable way so that it may be easily rotated in relation to the coil L3. The writer will leave the actual mechanical construction to the individual readers.

SELECTING THE CRYSTAL

Now let us come down to the actual heart of one of these simple receivers—the crystal itself. Another name for this little part used to be mineral, but of late so many synthetic materials have appeared on the market that today crystal is the generally accepted term. In the writer's opinion there is nothing better than a really good piece of galena but that particular little thing is rather hard to find. If you go out in the market today and pay anywhere from 10 to 25c for a piece of crystal, you may have to buy a dozen of them before you find one that is really exceptional. Of course, all of them will work more or less, but to get the very best of results, you must have several crystals on hand so that you can pick and choose among them.

The writer found that the very best way to do this was to go directly to the source of supply and purchase a piece of galena, weighing half a pound or more. You can then take this home and carefully break it up into small fragments, obtaining hundreds of them, each being amply large for use in a crystal detector stand. Then you can begin a most interesting series of tests, going carefully over the surface of each one of the crystals and sorting them according to their degree of sensitiveness. Out of all of these you may find 6 or 8 that show up very well. Now go over the process of elimination again until you have found one of these crystals which is the best of the lot. Then you will probably have in your possession a crystal that can hardly be beaten by anything short of a vacuum tube. Throughout this entire process of elimination, there

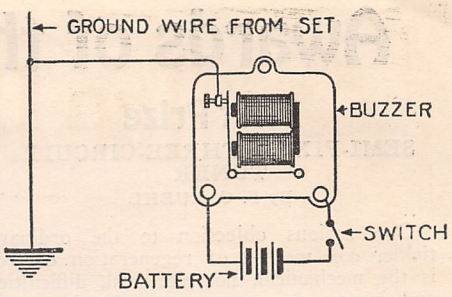


FIG. 6

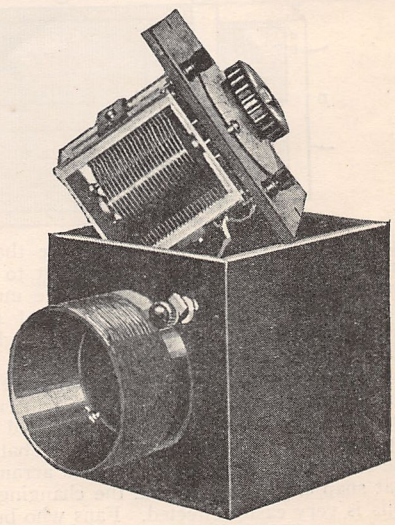
The connections in the diagram above show how a buzzer should be hooked up for testing crystal detector circuits.

is one thing that must be remembered. Do not attempt to handle the crystals with your bare hands. Regardless of how clean they may be, there is always a certain amount of oil present on the surface of the skin and this oil if it gets on the crystal, will form a minute film that may destroy or reduce its sensitiveness. Therefore, provide yourself with a small pair of tweezers with which you can pick up the pieces of mineral and transfer them from one place to another without danger of contamination.

Of course, there are other minerals and crystals worthy of consideration, but for all around use, in a simple crystal set that does not employ vacuum tubes for either radio or audio frequency amplification, galena is hard to beat. Some synthetic and so-called treated galena is very good, but here again it is usually procurable in single small pieces and you may have to buy several before you strike the best one. Silicon, a product of the electric furnace, makes a very good detector but it is not quite as sensitive as galena. It possesses one advantage, however, and that is that it is much more stable because of the fact that a much heavier pressure is used on its surface than on the surface of galena. In the case of the latter, a very light contact must be used at all times and it can plainly be seen that this contact can easily be jarred off. In the case of silicon, however, you can jam a sharp-pointed rod down hard on the surface of the crystal and it will give good results. This sort of an adjustment is, of course, hard to loosen and therefore you do not have to adjust the catwhisker or contact as much with silicon as you do with galena.

A good many permanent and semi-permanent crystal detectors have recently appeared on the market. Most of these are excellent for use in reflex and other sets that use tubes, but they are usually not quite as

(*Continued on page* 650)



A standard type of wave-trap that will increase the selectivity of circuits is shown in the photograph above.

Awards of the $50 Radio Wrinkle Contest

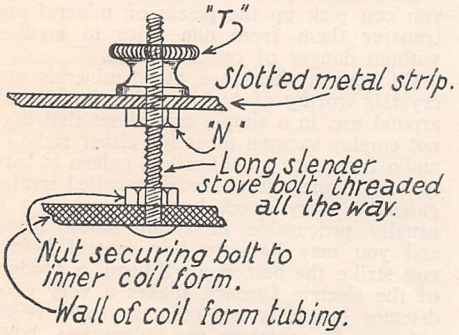
First Prize

SEMI-FIXED THREE-CIRCUIT TUNER

By F. C. RUEHL

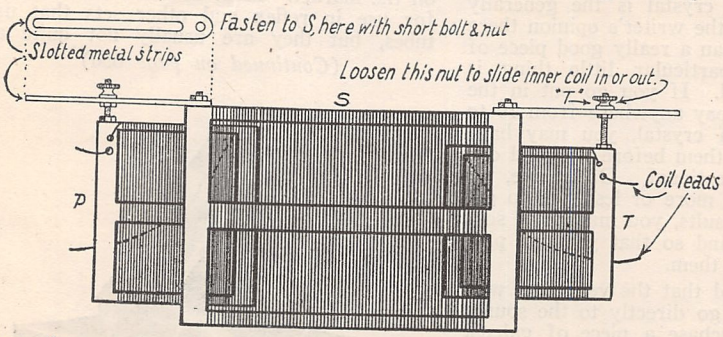
One serious objection to the ordinary tickler coil method of regeneration control is the mechanical, not electrical, difficulties and inconveniences encountered. Many of these difficulties may be overcome and the control of the regeneration actually made smoother, by using a fixed tickler coil with a series variable condenser.

The accompanying sketch clearly shows a simple system of this type of regeneration control. S, the secondary, is wound in a manner and style to suit the fan's own requirements. P, the primary, should have from 10 to 15 turns and be of such a diameter that it fits fairly snugly inside the secondary. T, the tickler, should have a smaller diameter than P, for two reasons: to keep its field



Constructional details of the method of attaching the adjustable coils to the frame are shown above.

from spreading too much and also to reduce to a minimum its effect on the tuning of the secondary. The number of turns of T should be between 25 and 30. The metal strips, should be of material stiff enough to support the coil without appreciably sagging when the movable coil is near the outer end. The nut, n, should be adjusted to such a position that the inner coil centers properly with the secondary. This adjustment having been determined, solder the nut to the bolt, or use a lock-nut to keep it in position. To adjust the coupling simply loosen the thumb nut, T, and slide the coil in or out to the proper position and then tighten the nut.



By suspending the primary and tickler coils in this way very fine adjustments can be made which will be semi-permanent.

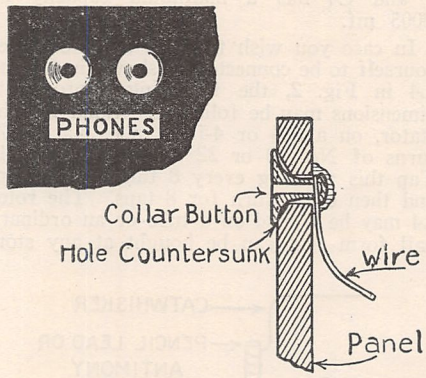
The tickler should be so adjusted that oscillation is just possible on the highest wave-length, when the condenser plates are entirely in mesh. One great advantage of this scheme is the ease with which different unit coil combinations may be substituted for long or short wave-length work. That is, the leads from the coils may be so arranged that snap clips are used and the changing of coils is very easily effected. Fans who build receivers using this method of coupling will doubtless find it to be one of the smoothest working couplers they have used.

Second Prize

FIVE-CENT EMERGENCY JACKS

By J. V. MORAN

Many constructors of experimental radio sets take great pride in seeing just how much of the apparatus that goes into a receiver can be made from spare parts in the junk box. Although the "parts" needed for these jacks are not generally in the radio junk box,



The lowly collar button has at last been applied to radio. They make efficient jacks for phone tips.

they are bound to be somewhere around the house. These parts are nothing more than two collar buttons.

As almost all collar buttons have holes in them, it is only necessary to see whether the tips of the phone cord will fit snugly. If the holes are too large, with a pair of pliers pinch the shaft in order to reduce the size of the opening, and if the hole is too small it can be easily enlarged by spreading the soft metal with a nail and hammer. Holes having a slightly smaller diameter than that of the smallest part of the button are then drilled in the panel. These holes are then countersunk on the front of the panel so that the buttons will be flush with it. Place the buttons in their holes and twist the connecting leads to the part projecting through the rear of the panel. Then, with a good hot soldering iron, place a ball of solder around the shaft of the button, as shown in the accompanying illustration. This will not only hold the jack in place but will provide an excellent contact.

Third Prize

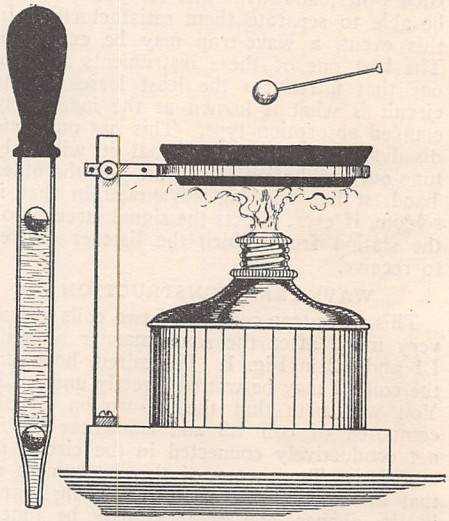
HOME-MADE BATTERY TESTER

By LYONEL GOODENRATH

One of the chief parts of a radio receiving equipment is the storage battery, and all too often this does not get the attention that it merits. Often it is allowed to remain in a discharged condition, which is very unwise. There are also several other difficulties which could be avoided if proper use was made of a hydrometer. Too often hydrometers are not replaced if broken, and yet there is a very simple method of repairing them and also for making new ones.

On the point of a pin place a piece of cork about the size of the head of a safety match and roll it in melted sealing wax until a generous amount is collected on the cork. When the wax has cooled, remove the pin and close the hole by holding the ball of wax over a flame. Then place the wax ball in either an old hydrometer tube or a large medicine dropper, and fill with solution from the charged battery. Sandpaper the wax ball until it just floats in the solution. Then prepare another ball of a different colored wax, but this time put the ball into a solution taken from the battery when it is in a *discharged* condition. These two balls are then placed in a hydrometer case, as mentioned above.

The method of testing with this hydrometer is to draw some of the battery solution



Small balls made of cork and sealing wax can be used for hydrometer floats.

up into the hydrometer, and if one of the balls, for instance, the red one, which can be used to indicate the discharged condition, floats and the other one sinks, the battery needs charging.

Prize Winners

First Prize $25
SEMI-FIXED THREE-CIRCUIT TUNER
By F. C. RUEHL
5215 Tennessee Ave., St. Louis, Mo.

Second Prize $15
FIVE-CENT EMERGENCY JACKS
By J. V. MORAN
1603 First Ave. N., Seattle, Wash.

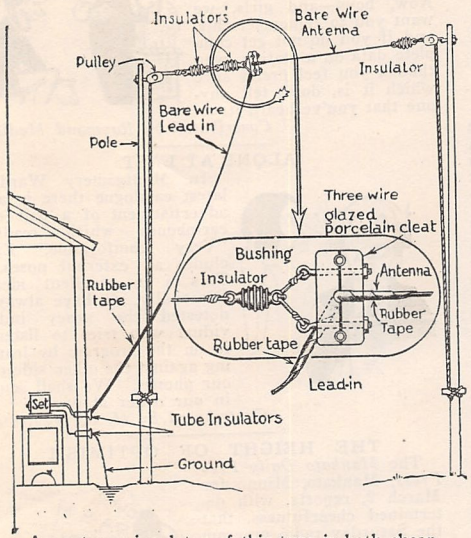
Third Prize $10
HOME-MADE BATTERY TESTER
By LYONEL GOODENRATH
Shelby, Mich.

NOTE: The next list of prize winners will be published in the January issue.

AN ANTENNA CLAMP

Although few radio fans realize it, one of the places where there is possibility of extremely large losses is the connection between the antenna and the lead-in. This possible loss may be eliminated by having the antenna and lead-in all one piece of wire, as described below.

The antenna clamp shown in the sketch is made from two porcelain clamps such as are used in house wiring. They should be of the "three-wire" variety, so that the antenna wire can be run through the middle groove and a bushing placed in the two outside grooves in order to prevent the cleats from breaking when pressure is applied to them after they have been placed in position. The antenna wire itself is insulated for about ten inches with heavy rubber friction tape at the point where it passes through the



An antenna insulator of this type is both cheap and efficient.

cleats and it is also insulated with the same tape for about twenty feet from the place where it enters the house. The drawing is self-explanatory, and if this system is followed, an efficient antenna should be the result.

Contributed by D. E. Phillips.

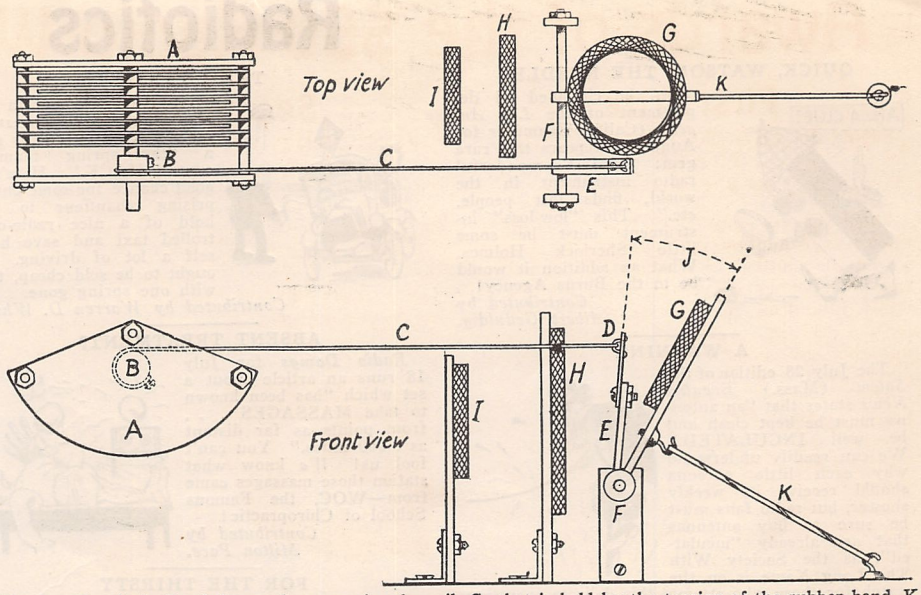


Fig. 1. The shaft, B, of the condenser varies the coil, G, that is held by the tension of the rubber band, K, to control the regeneration of the circuit.

AUTOMATIC REGENERATOR CONTROL

One of the chief tendencies in present-day radio receiver design is the reduction, as far as possible, of the number of controls. In the case of regenerative receivers, the constructor, by employing a little ingenuity, can eliminate one more control and still have his set working at the peak of efficiency.

The application of this principle to a tickler feedback set is shown in the drawing at Fig. 1. A is the tuning condenser, either 11- or 23-plate. The shaft, shown at B, should preferably have a diameter of one-half inch, with a set screw as shown. To this set screw, or to a lug which may be soldered on the shaft, a heavy linen thread, C, is secured and wrapped once or twice around the shaft. The other end is fastened to an arm, E, which is fastened to the tickler shaft, F. A rubber band, K, exerts a constant pull on the tickler, G.

The device is set as follows: With the plates of condenser, A, in full mesh, and with the thread C in such a position that as the condenser capacity is decreased, or the dial moved toward zero, the arm E is pulled toward the condenser, adjust the length of C so that the arm E is vertical. Then change the position of the tickler coil, G, by varying the angle, J, until the set is at the peak of the regeneration, without being in oscillation. Now try tuning in stations at various wave-lengths. If the tickler is in the correct position on the higher wave-lengths, but couples too closely on the lower wave-lengths, causing the set to spill over into oscillation, the arm E is too long; if the coupling is not close enough at the lower wave-lengths, the arm E is too short. With a ½-inch condenser shaft the arm E should be between 2 and 2½ inches long; in order to secure the best position, it is advisable to provide a variable adjustment as shown at D, so that the length of the arm may be readily changed.

After these adjustments have been made, they may be left permanently. If the set is used in a different location, with a dif-

(*Continued on page* 740)

Radio Set Directory

Continued from October Issue

Manufacturer: CONCERT RADIOPHONE CO.
1938 Euclid Ave., Cleveland, Ohio

Trade Name: Monotube
Circuit: Three
Batteries: Storage or dry cell
Antenna: Outdoor
Controls: Two
List Price: $12.50

* * *

Trade Name: Tritube
Circuit: Three
Batteries: Storage or dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $35.00

* * *

Trade Name: De Luxe
Circuit: Tuned radio frequency
Batteries: Storage or dry cell
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $75

* * *

Trade Name: Concert Grand
Circuit: Tuned radio frequency
Batteries: Storage or dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $50

* * *

Trade Name: Concert Supreme
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor or loop
Loud Speaker: Separate
Controls: Two
List Price $190.

Manufacturer: COSMOPOLITAN PHUSIFORMER CORP.,
15-17 West 18th St., New York City

Trade Name: Cosmopolitan 5-tube panel 7 x 18
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $59

Manufacturer: DAYTON FAN & MOTOR CO.
Monument and Meigs Sts.
Dayton, Ohio

Trade Name: O. E. M. 12.
Circuit: Tuned radio frequency
Batteries: Dry cell or storage.
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $75.00

* * *

Trade Name: O. E. M. 7
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $93.00

* * *

Trade Name: Dayola
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $110.00

* * *

Trade Name: Day-Fan
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $115.00

* * *

Trade Name: Dayroyal
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $300.00

* * *

Trade Name: Dayphone
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $105.00

Trade Name: Daycraft
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $145.00

* * *

Trade Name: Daygrand
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $195.00

* * *

Trade Name: Daytonia
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $300.00

* * *

Manufacturer: DE WITT-LA FRANCE CO.
54 Washburn Ave., Cambridge, Mass.

Trade Name: Superadio Reactodyne R. F.
Circuit: Radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $56

Manufacturer: DIMMOCK-BOGART RADIO INC.
137th St. and 3d Ave.
New York City

Trade Name: Arionola M-4 Balanced R. F.
Circuit: Balanced radio frequency
Batteries: Storage
Antenna: Either or without
Loud Speaker: None
Controls: Two
List Price: $50

* * *

Trade Name: Arionola M-4L Balanced R. F.
Circuit: Balanced radio frequency
Batteries: Storage
Antenna: Either or without
Loud Speaker: Built-in
Controls: Two
List Price: $50

(*Continued on page* 658)

Radiotics

QUICK, WATSON, THE NEEDLE!

In the classified ad department of the *Los Angeles* (Calif.) *Examiner* for August 2 appears this rare gem: "Most wonderful radio instrument in the world, finds lost people, etc." This "low-loss" instrument must be some little Sherlock Holmes. What an addition it would be to the Burns Agency!

Contributed by Albert Geduldig.

A WARNING

The July 28 edition of the *Salem* (Mass.) *Evening News* states that "an antenna must be kept clean and be well INCULATED." We can readily understand why each little antenna should receive its weekly shower, but radio fans must be sure to buy antennas that are already "inculated", as the Society With The Long Name is on the watch for those who attempt this delicate operation.

Contributed by Charles A. Smith.

OF COURSE!

An article on trouble-hunting in a pamphlet issued by the Boonton Rubber Company, of Boonton, N. J., advises the experimenter to "remove tubes from SOCKERS when changing connections." Surely this would be best, for how could a delicate tube withstand the brutal attack of a socker?

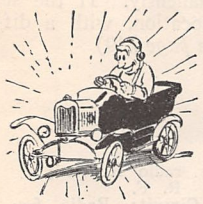
Contributed by Henry Willier.

SOME COIL!

The *Radio World* for July 25 in one of the articles gives the specifications of a very unusual coil, "using No. 24 SOC." We advise the baffled set-builder to try the extra-size counter of the hosiery department or else to use a full pair of socks, size 12.

Contributed by Raymond Madill.

TRUTH WILL OUT



The *Minneapolis Tribune*, Minneapolis, Minn., for March 22 advertises a "one-tube radio pop-corn cabinet, fits on Ford car." So—*this* is where all the popping and cracking has been coming from! And we've been blaming it all on the poor little "B" battery.

Contributed by R. D. Lewis.

TWO-IN-ONE

The Questions and Answers department of *Popular Radio* for September advises the inquiring fan that "three standard sockets should be used for the last three tubes and one 199 type of socket for the first two." This is a novel and intriguing departure from radio practice. We like the idea—but what do we use to get that second tube in? A shoe horn?

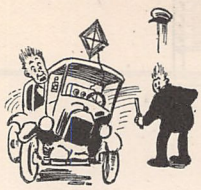
Contributed by J. B. Greenman.

A MARTYR TO SCIENCE

The *Evening News*, Harrisburg, Pa., for February 28 has a tremendous scoop! The condition of the battery, they say, was not tested by a hydrometer but "by a VOLUNTEER!" What sacrifices man must make to Science! And just before he entered the battery, we'll bet this hero "only regretted that he had but one life to give" for his hobby.

Contributed by Edward H. Bitner.

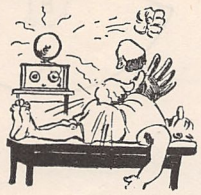
TAXI! TAXI!



An Advertisement in the *American Radio Transmitter* for April offers for sale a "three-spring filament control HACK." Here's a good chance for some enterprising chauffeur to get hold of a nice radio-controlled taxi and save himself a lot of driving. It ought to be sold cheap, too, with one spring gone.

Contributed by Warren D. White.

ABSENT TREATMENT?



Radio Doings for July 18 runs an article about a set which "has been known to take MASSAGES . . . from points as far distant as 6,000 miles." You can't fool us! *We* know what station those massages came from—WOC, the Famous School of Chiropractic!

Contributed by Milton Pace.

FOR THE THIRSTY

The radio section of the *Hartford Times* (Hartford, Conn.) for August 19 has an article headed "Chart for Use in CELEBRATION." This is hot stuff! We never *can* find one of those "talk-softly" places when we want to celebrate—map of them would be great! Where can we buy it?

Contributed by Paul B. Wheaton.

IF you happen to see any humorous misprints in the press we shall be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. We will pay $1.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

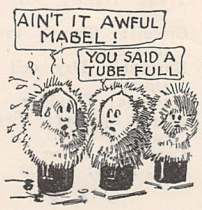
Editor RADIOTIC DEPARTMENT,
c/o Radio News.

NO TUBE SETS NEEDED THERE

On May 24 the *Springfield Republican*, of Springfield, Mass., in relating that some stations were going to increase their power, said that "Station WBZ, Springfield, would broadcast with 20,000 watts." All the good people of this vicinity need is a crystal detector and a loud speaker and that volume of WBZ's should knock them over.

Contributed by Dr. H. S. Thomson.

A HOT ONE



In the Radio Trouble column of the *Boston Daily Advertiser* (Boston, Mass.) for August 18, a radio fan states that he "is using a FUR-TUBE neutrodyne with U. V. 199 tubes" and can't understand why it won't operate one of the new type loud speakers. Suffering tubes! Who can blame them on a hot August day? They should by all means be removed and kept in cold storage till next winter, when they may bring in Alaska or the MacMillan Expedition.

Contributed by Charles A. Smith.

BANG! BANG! ALSO BOOM

In the Cumberland, Md., *Evening Times* of July 25 in giving advice to coil winders there appeared "start the coil with thread and FIRE." This is something that should have been used by the A. E. F. in the recent argument across the drink, when the gun plants were working so hard.

Contributed by P. Amtower.

SMACKS OF TAMMANY HALL

The *Wichita* (Kan.) *Beacon* of July 15 in reporting a speech said that "it was broadcast over the country by a national HOOK-UP OF A DOZEN CITIZENS." Is this one of these here political rings, that due to the influence of radio on the vocabulary of these United States, is now called a hook-up? Somebody elucidate, willya?

Contributed by E. R. Siefkin.

AND THAT'S TRUE

On July 19 the *Philadelphia Inquirer* had in answer to a radio question in which it was told that "Very little will be gained in distant DECEPTION." Now, boys—and girls, we want you to remember this, and if you do not get complete data on a station even though you feel *pretty* sure which it is, don't tell anyone that you've heard it.

Contributed by Raymond Madill.

ALONE AT LAST

In Montgomery Ward's latest catalogue there is an advertisement of a pair of ear-phones which reads: "Very comfortable, Excludes all external noses." This is an excellent idea. Personally, we have always detested the nosey individual who tries to listen-in on the program by leaning against the other side of our phones. We shall send in our order at once.

Contributed by H. L. Westrate.

THE HEIGHT OF OPTIMISM

The *Mankato Daily Free Press*, Mankato, Minn., for March 2, reports, with determined cheerfulness, that the Saturday radio program was excellent and "the static was fine." This is a novel and very admirable point of view. We only wish there were more little Pollyannas like this to brighten up the radio game.

Contributed by Ewood Graham.

NOW WE KNOW

The *Montreal Daily Star* for August 11 in an article on relief to Arctic traders by radio remarks: "The message . . . was picked up by the American Radio DELAY League." Aha! So *that's* why we have to wait so long for news from the Arctic Explorers!

Contributed by W. D. McClellan.

SHE'S A LIVE WIRE

The *St. Louis* (Mo.) *Star* for August 21 publishes a query from one of its readers who wants to know: "Whether or not a paper GIRL condenser is just as good as one having mica as a dialectric." Of course, we don't know, but we should say she was much better—if you don't mind being "shocked" a little.

Contributed by Donald Bond.

THE MODERN MIRACLE

The *Los Angeles Evening Herald* of Los Angeles, Calif., announced, on July 18, something which should prove a boon in this poverty-stricken world of ours. The item begins: "Over a BREADCASTING station in Chicago just a twinkle of an eye ——" This is a remarkable innovation. We suggest a slogan for this station: "Say it with flour" and recommend liberal breadcasting during the dinner concert hour.

Contributed by Conrad Pembrook.

STANDARD HOOK-UPS

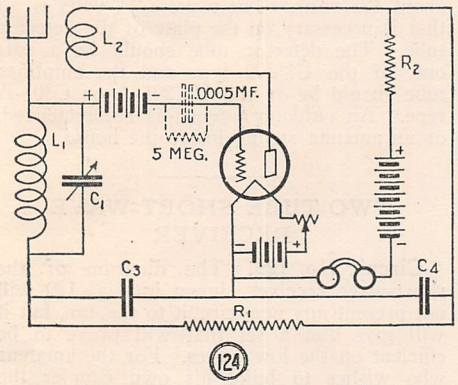
EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c per sheet to pay for mailing charges.

RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

Handy Reference Data for the Experimenter

SIMPLIFIED SUPER-REGENERATIVE RECEIVER

Circuit No. 124. For the experimenter who prefers to delve into the more intricate radio circuits, there are none that hold such possibilities as the super-regenerative hook-ups. Many fans have experimented with this type of circuit and have given up in disgust, but for all that, there are some "supers"



One of the easiest "supers" to build is shown above. It is simple from both a mechanical and electrical point of view.

that do function as they should—and what is more, they function extremely well, giving to the builder more satisfaction than is usually the case, because of a hard job done well.

In general, the intention of super-regenerative circuit designers has been to reduce the number of tubes to a minimum, which in most cases is one. Some of the "flivver" circuits—as the single-tube super-regenerators are called—have been reported as giving results far beyond what might logically be expected, especially as regards volume from local stations.

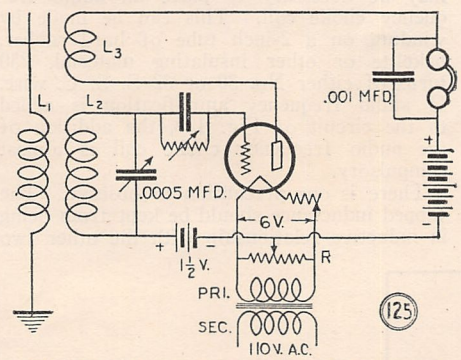
There have been many adaptations and the one in Fig. 124 is known as the Bishop Ultra-Regenerator, the chief virtue of which lies in its extreme simplicity. Most any amateur can find the necessary parts in the junk box and if not there, they can be procured at a small cost. The coils, L1 and L2, are honeycomb coils of 50 and 100 turns respectively. The variable condenser, C1, has a capacity of .0005 mf. (23 plates). The fixed condensers, C3 and C4, have the same capacity .002 mf. The resistance, R1, may be either a 1,250-turn honeycomb coil or a 10,000-ohm resistance. R2 should be a honeycomb coil having 500 turns. The grid leak and grid condenser are shown in the drawing in dotted form, because these two pieces of apparatus are not absolutely essential to the circuit. However, if they are used, the use of a "C" battery becomes optional.

To cover the broadcast wave-length range, the value of L1 is as mentioned above, but the value of the inductance of L2 is more or less flexible. In fact, the correct number of turns of L2 must be determined by experiment, as it lies somewhere between 75 and 125 The best way to find this value is to wind cylindrical coils on a 3-inch tube and by trial find the combination that gives the best results. The hook-up as shown in Fig. 124 is for use with a regular antenna and excellent results have been obtained with this method. However, an interesting variation might be to substitute a loop antenna for L1 and a smaller loop revolving inside the larger one, for L2. This method of feedback was explained on page 497 in the October, 1924, issue of RADIO NEWS. If a combination such as this is employed, there must be more turns in the smaller coil than in the outer coil of the loop. This number is best obtained by experiment and is left to the builder.

A hard tube is the best to use in this circuit, *i. e.*, one of the UV201-A or C301-A type. Of course, if the experimenter has a VT2 tube in the collection he should try that, for it is one of the best tubes to use in circuits of this character.

THREE-CIRCUIT TUNER USING 110 VOLTS FOR FILAMENT LIGHTING

Circuit No. 125. One of the problems on which radio engineers have been working and have just brought to a rather successful solution, is that of lighting the filaments of vacuum tubes from house-lighting circuits. Generally there is necessary a more or less elaborate system of filters and that is something which the average experimenter does not care to undertake.



The bell-ringing transformer is used for lighting the tube filament and the potentiometer, R, for balancing the circuit.

In Fig. 125 is shown a diagram of connections in which the filament of the tube is lighted from the 110-volt A.C. house lighting circuit. The transformer used for stepping down the 110 volts to the filament potential is one used for bell-ringing. Across the secondary is the resistance, R, which is a potentiometer of at least 400 ohms. In one side of the filament circuit is an ordinary rheostat for adjusting the filament current. This type of circuit needs very careful adjustment, as if either the rheostat or the potentiometer settings are changed the other must be reset to keep the circuit in balance.

The inductances, L1, L2 and L3 may be three honeycomb coils and have 10, 50 and 30 turns respectivelv. These may be mounted in the usual manner in a three-coil mounting, so that their inductive relationship may be varied. The grid leak and grid condenser may be of the ordinary sizes common to this type of circuit. The 1½-volt battery in the lead between the potentiometer arm and the coil, L2, is the "C" battery and is necessary to give the grid the proper positive bias essential to good detection.

ONE-TUBE RECEIVER USING 110 VOLTS FOR FILAMENT LIGHTING

Circuit No. 126. In the accompanying illustration is another circuit that uses the house-lighting current for supplying the power for the filament. The inductances and variable condenser are the same as were used in Circuit No. 125, so these values will not be given again.

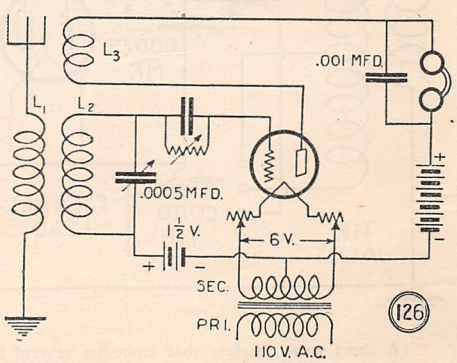
One difference in this circuit is that the step-down transformer is one in which the secondary has a middle tap, which is connected to the negative side of the plate battery. A second difference is that there is a rheostat in each lead connecting the filament to the secondary of the transformer. This type of transformer is used because the filament supply system is much more stable and balancing comparatively easily done by adjusting the two rheostats.

This method of lighting the filaments of vacuum tubes from the 110-volt house-lighting circuit is one of the most interesting with which the fan can experiment today. There are, of course, many methods of eliminating the batteries, but one of the simplest as well as one of the most stable, is the one shown in this circuit.

THREE-TUBE MYSTERY CIRCUIT

Circuit No. 127. Compared to the intricate wiring diagram of the super-heterodyne and the neutrodyne circuits the one shown in Fig. 127 is simplicity itself. But —and here is the main point—it gives practically as much volume as either. It is neither one of the above-mentioned circuits and it certainly is not reflex, but suffice to say here it works and it works well, giving excellent volume and reproduction.

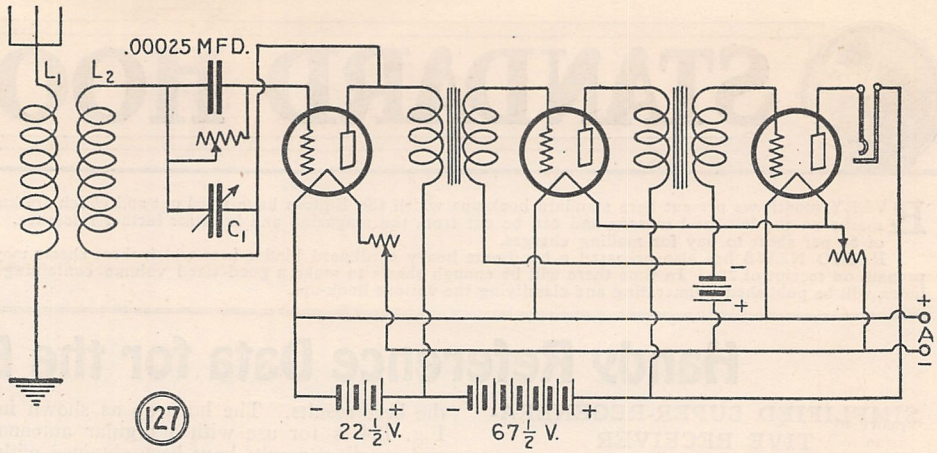
The primary inducance coil, L1, consists of 20 turns of No. 18 enameled copper wire and the secondary coil, L2, has 60 turns of No. 28 enameled copper wire. These two



A tapped secondary in the bell-ringing transformer makes this circuit very stable in operation.

coils should be of the low-loss type. One of the best types to use in this circuit is the coils that are wound on a form on which is placed gummed paper with the gummed side up, the coil wound over this and the form then removed, making the coils air-cored. For the primary coil a form 3 inches in diameter is used and one for the secondary 2½ inches in diameter. The variable condenser, C1, is one having 17 plates. However, if the constructor has on hand a pair of coils wound with No. 24 D. C. C. wire with 10 or 15 turns on the primary and about 50 turns on the secondary wound with the same size wire on a 3-inch tube, either one on top of the other or alongside each other, these may be used instead of the coils described above. In case a coil of different inductance is used in the secondary, there must be employed another condenser. If there is used a coil of 50 turns, then a condenser having a higher capacity must be substituted for the one already mentioned—in this case, one having a capacity of .0005 mf., or 23 plates.

The output of the detector tube is shown connected to the input side of two stages of transformer coupled audio frequency amplification.



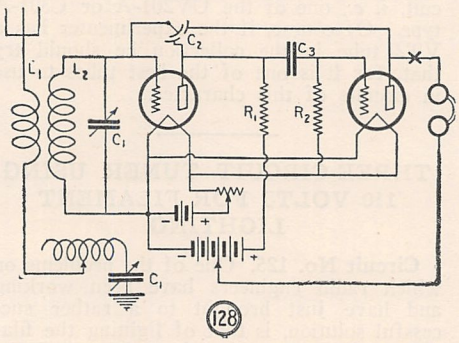
Here is a receiver that compares favorably in operation with sets using more tubes. There is but one tuning control.

RESISTANCE COUPLED R. F. AMPLIFIER

Circuit No. 128. For the radio fan who is anxious to reach out for distant reception one of the best things he can add to his recevier is at least one stage of radio frequency amplification. As is true with audio frequency amplification, there is more than one method of coupling the stages in radio frequency amplification and one of the best known is resistance coupling. Although the amplification may not be so great per stage, yet the quality should be of the finest.

One of the main difficulties that is encountered in radio frequency amplification is keeping the receiver from breaking into oscillation. There are several ways of preventing this, as introducing a potentiometer in the grid circuit of the R. F. tube, but one of the best methods is to connect a compensating condenser, C2, as is shown in Fig. 128 between the grids and the plate of the R. F. amplifier and detector tubes. This compensating condenser is one having three plates, each of which is connected to a terminal for exterior connections.

The inductance coils, L1 and L2, are wound on the same 3-inch insulating tube. The secondary, L2, is wound first and consists of 50 turns of ordinary No. 18 bell wire. Tightly over the secondary is wound L1, which has three turns of the same size wire. The tapped inductance is also wound on a 3-inch tube and consists of 90 turns of No. 24 D. C. C. wire. This coil is tapped every ten turns from the 50th to the 90th turn. The condensers, C1, each have a capacity of .0005 mf. (23 plates). The fixed condenser, C3, has a capacity of .00025 mf. The resistance, R1, is equal to one-tenth of a megohm and the resistance, R2, is equal to two megohms. At the point in the plate circuit of the detector tube marked X, it



Above is shown a method of R.F. coupling that is efficient because the circuit is under control in respect to oscillation.

may be necessary to place an audio frequency choke coil. This can be made by winding on a 2-inch tube of hard rubber, bakelite or other insulating material, 250 turns of either No. 30 or 32 S. S. C. wire. If audio frequency amplification is added to the circuit of Fig. 128, the addition of the audio frequency choke coil is almost compulsory.

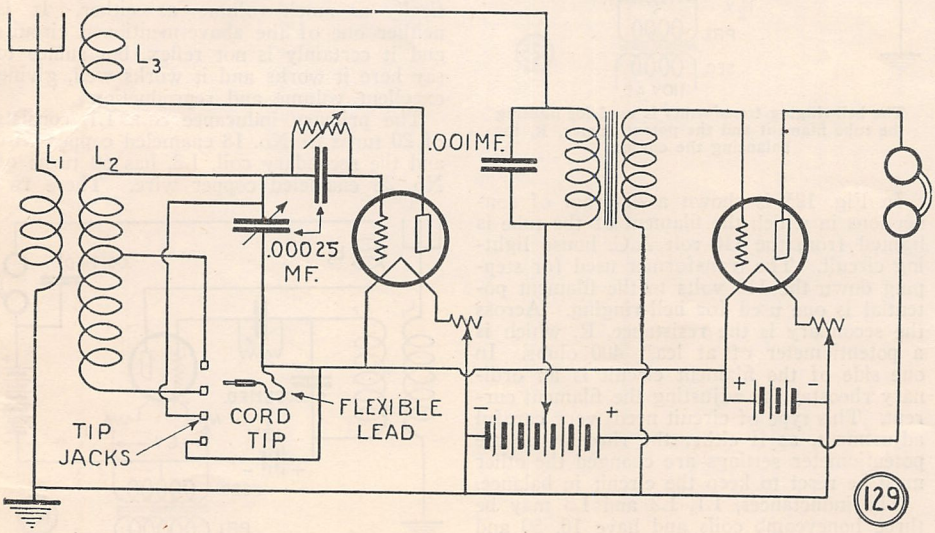
There is one precaution to observe. The tapped inductance should be kept from being in inductive relationship with the other two inductances, L1 and L2. This means that they should be at least six inches from each other. The plate voltage of the amplifier tube should be higher than is usually used with transformer coupled amplification—about 125 volts. The usual 22½ volts is all that is necessary on the plate of the detector tube. The detector tube should be a soft one, of the UV200 type and the amplifier tube should be of the UV201-A or C301-A type. An outdoor antenna is recommended, or an antenna strung inside the house.

TWO-TUBE SHORT-WAVE RECEIVER

Circuit No. 129. The diagram of the short-wave receiver shown in Fig. 129 will not present any new circuit to the fan, but it will give him a set that will prove to be efficient on the low waves. For the amateur who wishes to build his own coupler the dimensions are as follows: The primary, L1, is wound on a 2¾-inch bakelite or hard rubber tube and consists of No. 16 or No. 18 D. C. C. wire wound near one end of the tube. The tickler coil, L3, is wound on a similar tube, but the winding consists of 10 turns of No. 20 D. C. C. wire. Both these coils, L1 and L3, must be so mounted that it will be possible to vary the amount of coupling between them and the secondary, L2. This is done by mounting them on shafts that are at least 4 inches in length and which are connected to the end of the tube away from the windings. In this manner very loose coupling will result. It was found that by using these dimensions very little effect on the wave-length of the receiver was made by varying the tickler coil—which is of great advantage in short-wave work.

The secondary, L2, is stationary and is of the basket-weave type, being supported from the panel by two insulating strips. The coil is 4 inches in diameter and consists of 19 turns of No. 12 or No. 14 D. C. C. wire with a tap at the 10th turn. The winding form for this coil consists of 15 twenty-penny nails placed evenly in a circle 4 inches in diameter. The winding is accomplished by bringing the wires under and over every third nail. The coil is bound with strong twine, wound in and out of the openings in the coil.

With an 11-plate condenser shunted across the secondary the wave-length range is from 40 to 200 meters. If it is desired to extend the range of the receiver a fixed condenser may be plugged into the two lower jacks shown in the sketch. This condenser, which may be either .0005 or .00075 mf., is fitted with phone tips so that it will make connections in the jacks. These jacks are mounted on the front of the panel for ease in changing connections. Further details of this receiver may be found in the April, 1925, issue of *The Experimenter*.

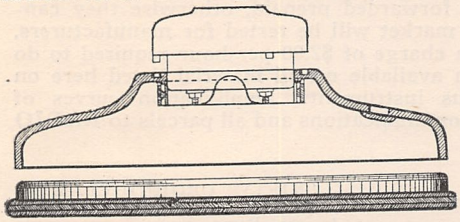


A short wave receiver that embodies several innovations. The method of changing wave-lengths is extremely simple.

By JOHN B. BRADY*

(1,535,734, D. H. Moss, filed February 9, 1924, issued April 28, 1925. Assigned to C. Brandes, Inc., New York.)

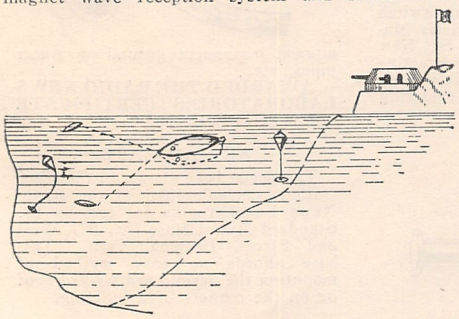
Support for table talkers and method of making the same. The patent shows a method of construction for an electro-magnetic sound reproducer.



The construction of the base and means for mounting the acoustic reproducer therein described in connection with the process of manufacture by which the instruments can be inexpensively produced on a quantity production scale.

(1,529,065, J. H. Hammond, Jr., filed December 11, 1916, issued March 10, 1925.)

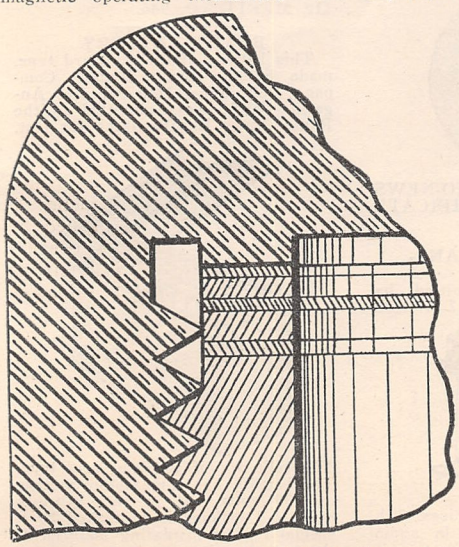
System of radio control of submarine vessels and other movable bodies. A combined electro-magnet wave reception system and sound wave



transmission system is illustrated whereby received radio signals are caused to actuate a submarine compression wave sound transmission system for transmitting energy under water for control of sound-receiving devices on board the submarine vessel.

(1,526,626, C. E. Brigham, filed March 13, 1924, allowed Feb. 17, 1925. Assigned to C. Brandes, Inc., New York.)

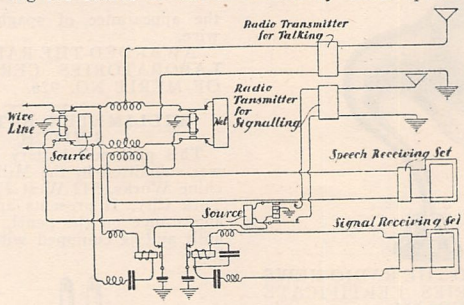
Electro-magnetic sound reproducer for radio reception, in which a diaphragm is resiliently supported at its periphery for operation by an electro-magnetic operating mechanism. The diaphragm



is supported by a pair of relatively thin rings, one positioned on one side of the diaphragm and the other positioned on the opposite side of the diaphragm. The rings are composed of layers of dissimilar material formed integrally with each other and remain in permanent adjustment with respect to the electro-magnetic sound reproducer. This patent covers the Brandes Table Talker.

(1,528,010, C. S. Demarest and M. L. Almquist, filed December 31, 1923, issued March 3, 1925. Assigned to American Telephone and Telegraph Co., New York.)

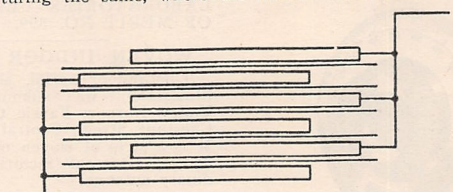
Radio signaling system combining the advantages of line wire and radio communication. Separate receiving circuits are provided for the reception of speech modulated and signal modulated carrier currents. The arrangement of the receiving circuits is such that a large amplification of the particular detected frequency or range of frequencies, which it is intended to secure, may be received. The patent describes a terminal circuit which may be connected to a transmitting or receiving antenna with switching means for modulating the source of carrier current by either speech



currents or telegraph signaling currents. The switching means is actuated by signaling currents transmitted over the line for connecting the modulating circuit in desired relation to the antenna system and control circuits.

(1,533,611, W. R. Respess, filed December 22, 1923, issued April 14, 1925. Assigned to New Jersey Research Company,)

Electrical condenser and method of manufacturing the same, where the metallic armatures are

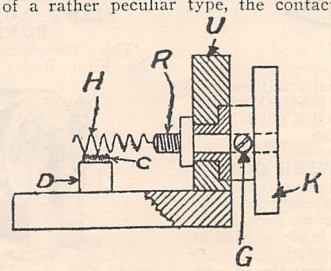


coated with rubber in solution which, when dry, forms an insulating filament directly upon the conducting plate, permitting condensers to be built up by stacking the conducting plates one upon another.

A NOVEL DETECTOR

(Application date, February, 14th, 1924. No. 233,-782.)

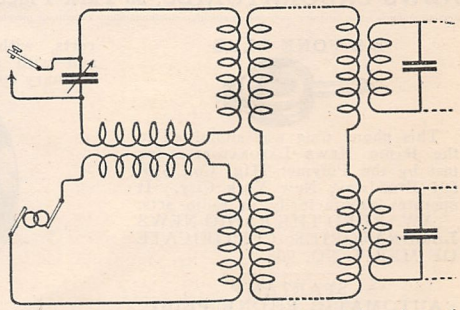
British Patent No. 233,782 granted to the British Thomson-Houston Company, Ltd., and W. F. Boyd, gives details of a crystal detector illustrated by the accompanying diagram. The crystal detector is of a rather peculiar type, the contact being



obtained between the surface of the crystal and a wire helix. Thus the crystal is held in a cup D fixed to a base B, supporting an upright bracket U, which carries an adjusting device. In the modification shown this consists of a rod R provided with a knob K fixed by means of a grub-screw G. The end of the rod carries a metal helix H, the convolutions of which are in intimate contact with the surface of the crystal C. Thus it will be seen that on rotating the knob the helix will revolve and the point of contact will move down the surface. In another modification the rod works through a threaded bush, and only one portion of wire is used. The contact thus advances at a rate proportional to the size of the thread.

(1,534,704, J. H. Hammond, Jr., filed Sept. 9, 1918, issued April 21, 1925.)

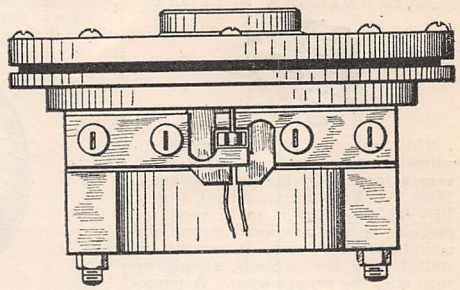
Receiving system for radiant energy, having



separate circuits in which two series of impulses of radiant energy having a predetermined phase difference may be utilized to control the operation of selenium cells at a receiver which, in turn, control circuits at the receiving station to selectively actuate the receiving mechanism.

(Patent No. 1,533,372, C. F. Brigham. Filed June 14, 1924; issued April 14, 1925. Assigned to C. Brandes, Inc.)

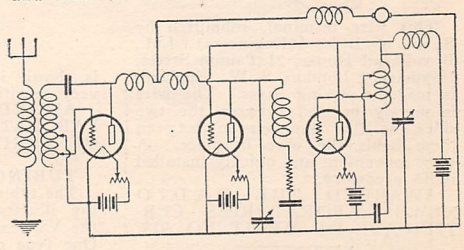
Loud speaker for radio reproduction, in which the maximum energy from the electro-magnetic fluctuations is derived by means of a freely floating armature disposed in the magnetic field. The



armature is arranged within the electro-magnetic field and is actuated by the variations in the magnetic flux in such manner that all of the vibrations are effectively employed for the reproduction of signals.

(Patent No. 1,624,413, M. W. Stearns. Filed January 28, 1920; issued January 27, 1925.)

RADIO TELEPHONE SYSTEM, in which the same tube circuit functions as a transmitter and receiver. The circuit is arranged for simul-



taneous transmitting and receiving. A grounded aerial circuit is provided with a tuning inductance connected thereto and a divided secondary circuit across one portion of which the input circuit of the tube is connected and across the other portion of which the output circuit is connected.

Patent Attorney, Ouray Building, Washington, D. C.

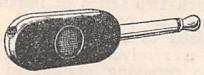
RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratory tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Apparatus ready for the market or already on the market will be tested for manufacturers, as heretofore, free of charge. Apparatus in process of development will be tested at a charge of $2.00 per hour required to do the work. The Laboratories will be glad to furnish readers with technical information available on all material listed here on receipt of a stamped envelope. The Laboratories can furnish resistances of the various instruments, amplification curves of transformers, losses in condensers, etc., and other technical information. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

E-Z FONE PLUG

This phone plug was submitted to the RADIO NEWS LABORATORIES for test by the Polymet Mfg. Co., 599-601 Broadway, New York City. It operates satisfactorily in radio sets.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 908.

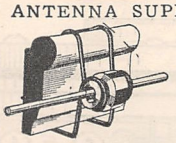
SPARTAN AUTOMATIC PHONE PLUG



This phone plug, submitted by the Spartan Electric Corp., 99 Chambers Street, New York City, is shown in the illustration. It works very satisfactorily in radio sets.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 917.

JIFE ANTENNA SUPPORT



This antenna support was submitted to the RADIO NEWS LABORATORIES for test by the Jife Company, 5568 W. Van Buren St., Chicago, Ill. This support is to be used for carrying indoor antennae around the mouldings of rooms. It can be installed in a few seconds, simply by springing the prongs open. A porcelain insulator is provided, through which the wire is passed.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 912.

SIMON WIRE TERMINAL

This wire terminal, submitted by Simon Bros. (Engineers) Ltd., Broadmead House, 21 Panton Street, Haymarket, London, S. W., England, is made of spring brass. The wire is merely pressed between the two sides, so that the tension between them holds the wire in place. A very convenient and quickly installed radio accessory.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 919.

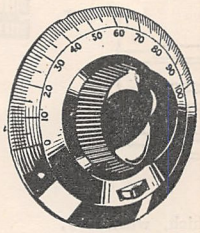
THE ORCHESTRION DE LUXE

This loud speaker, furnished by F. Bremerman & Sons, 3231 N. Illinois St., Indianapolis, Ind., was submitted to the RADIO NEWS LABORATORIES for test. It affords very good reproduction of radio concerts, without disturbing distortion and with sufficient volume for all ordinary purposes.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 870.

FRESHMAN VERNIER DIAL

The dial shown in the illustration was submitted by Chas. Freshman Co., Inc., 240 West 40th St., New York City. This dial is equipped with a small rubber roller which engages the panel by friction and allows very minute adjustment of the dial setting.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 915.

EVERSET CRYSTAL DETECTOR

This crystal detector, submitted by the Everset Laboratory, Box 41, Edgewood Station, Providence, R. I.

is shown in the illustration. It is very sensitive and easily adjusted.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 916.

TUBING AND WIRE CORE

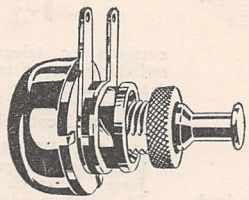
The tubing and wire core shown in the illustration were submitted by the Varflex Corp., Rome, New York. One type of tubing made is similar to the ordinary spaghetti. Another type consists of a woven braid covered by cotton and celluloid. A third type consists of a tinned bus wire covered with two layers of cotton. The whole is then covered with a black insulating material, giving it

the appearance of spaghetti-covered wire.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 926.

MILLIMETER BATTERY SWITCH

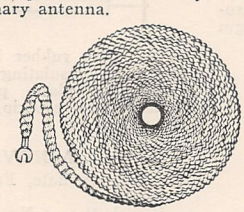
This push-pull battery snap-switch was submitted by the Millimeter Machine Works, 542 West 22d St., New York City. It presents an attractive appearance on the panel. It is well built and is equipped with soldering lugs.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 899.

WOVEN INDOOR AERIAL

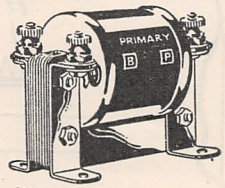
This indoor aerial, shown in the illustration, was submitted by the Valley Narrow Fabric Company, 59 Chestnut Street, Central Falls, R. I. It is a strip of woven metallic braid and operates satisfactorily as an ordinary antenna.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 815.

FLINT AUDIO TRANSFORMER

This transformer, submitted by the Flint Radio Co., 1817 Wilson

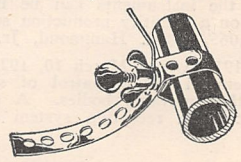


Ave., Chicago, Ill., reproduces with good volume and quality in audio frequency amplifiers.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 914.

"NIFTY" GROUND CLAMP

This ground clamp was submitted to the RADIO NEWS LABORATORIES for test by the Amoroso Mfg. Co., 14 Sears St., Boston, Mass. It affords an easy method of obtaining

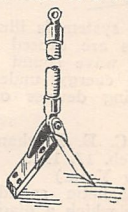


a good permanent ground on water pipes, etc.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 904.

AERIAL BASE

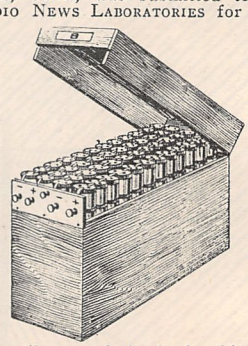
The aerial base shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Standard Aerial Base Co., 227 West 2nd Street, Pomona, Calif. This base affords an easy method of mounting the aerial on a peaked roof or on the corners of a building.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 946.

BRANT BATTERY

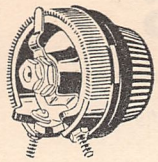
This battery of the standard type, made by the Brant Battery Company, 1622 West 16th St., Los Angeles, Calif., was submitted to the RADIO NEWS LABORATORIES for test.



The cells are of the lead acid type. The battery has a maximum voltage of 100 volts. It is very sturdily built and leakage is prevented by a special seal of insulating material at the top of each cell.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 869.

PILOT RHEOSTAT



The rheostat shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Pilot Electric Mfg. Co., 113-119 Broadway, Brooklyn, N. Y. This rheostat has a rate of resistance of six ohms and operates satisfactorily as a filament control in radio receivers.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 972.

LIQUID SPAGHETTI

The liquid spaghetti shown in the illustration was submitted to the

RADIO NEWS LABORATORIES for test by the Phenix Aircraft Products Co., Williamsville, N. Y. This liquid spaghetti comes in a variety of colors and can be used on bus wires and other bare wires wherever installation is required. It is very easily applied.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 960.

PILOT DIAL

This Pilot dial made by the Pilot Electric Mfg. Co., 113-119 Broadway,

Brooklyn, N. Y., was submitted to the RADIO NEWS LABORATORIES for test.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 943.

PILOT JACK

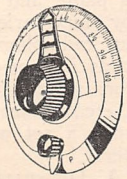
The jacks shown in the illustration were submitted by the Pilot Electric Mfg. Co., 113-119 Broadway, Brook-

lyn, N. Y., to the RADIO NEWS LABORATORIES for test. These jacks are well made and come in a variety of forms from single circuit to the more complicated filament control jacks and double circuit filament control jacks.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NOS. 971 AND 940.

VIBROPLEX DIAL

This dial was submitted by the Vibroplex Co., Inc., 825 Broadway, New York City, to the RADIO NEWS LABORATORIES for test. It is of the

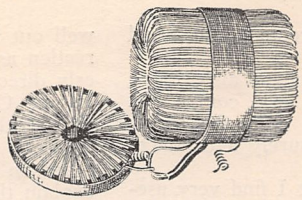


vernier type with a similar knob at the bottom to throw the vernier attachment in or out. When thrown one way the dial acts as the ordinary dial; when thrown the other way advantage is taken of the vernier motion.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 969.

TOROIDAL COIL

The toroidal coil shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Pathe Phonograph & Radio



Company, 20 Grand Avenue, Brooklyn, N. Y. This toroidal coil is well built and can be used satisfactorily in tuned radio frequency amplifiers. Provision is made for primary and secondary coupling.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 952.

ELECTRON TUBE

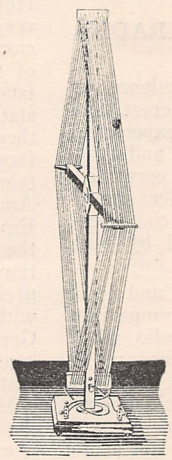
The tube shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Radio Products Company, 15 Moore Street, New York City. This tube has the

usual rating and operates satisfactorily as either amplifier or detector.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 968.

FIAT LOOP

The loop shown in the illustration was made by the Radio Appliance Laboratory, 4884-90 North Clark St.,



Chicago, Ill., and submitted to the RADIO NEWS LABORATORIES for test.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 984.

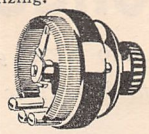
BATTERY HYDROMETER

The hydrometer shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Scranton Glass Instrument Co., Inc., Scranton, Pa.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 961.

TURK POTENTIOMETER

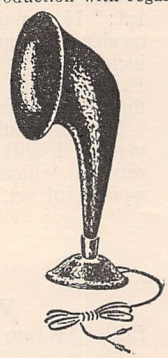
This potentiometer was submitted for test to the RADIO NEWS LABORATORIES by George Turk, 30 Irving Place, New York City. It acts satisfactorily in all radio receivers which require a variable potential for stabilizing.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 944.

LITTLE SPITFIRE LOUD SPEAKER

This loud speaker, shown in the illustration, was submitted to the RADIO NEWS LABORATORIES for test by the Tower Mfg. Corp., 98 Brookline Avenue, Boston, Mass. It gives very fine reproduction with regard to both



quality and volume. It is well made and attractive in appearance.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 991.

PLUG-IN COILS

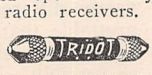
These coils were submitted by the Washburn Burner Corp., Kokomo, Ind., to the RADIO NEWS LABORA-

TORIES for test. They are of the plug-in type and are mounted in a base similar to the base of a tube. They can be mounted very easily and changed quickly in an ordinary tube socket.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 959.

GRID LEAK

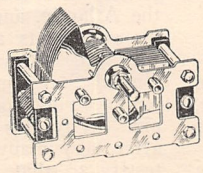
The grid leak shown in the illustration was submitted to the RADIO NEWS LABORATORIES for test by the Tridot Electric Co., Inc., 16 Hudson Street, New York City. It has a resistance very close to the rated values and operates very satisfactorily in radio receivers.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 958.

PILOT CONDENSER

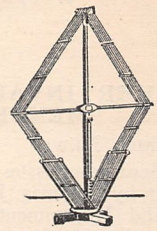
The condenser shown in this illustration was submitted to the RADIO NEWS LABORATORIES for test by the Pilot Electric Mfg. Co., 113-119 Broadway, Brooklyn, N. Y. This condenser has a rated capacity of .0005 microfarad.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 975.

COIL ANTENNA

This coil was submitted to the RADIO NEWS LABORATORIES for test by the Tobe C. Deutschmann Co., 46 Cornhill, Boston, Mass. It is of the collapsible type and operates satisfactorily over the broadcast range of wave-lengths with a .0005 condenser.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 957.

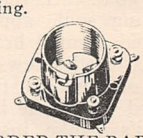
THOMAS STORAGE BATTERY

This battery, furnished to the RADIO NEWS LABORATORIES for test by the Thomas Battery Corp., 511 West 50th St., New York City, operates quietly and satisfactorily as a source of plate voltage for radio receivers.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 885.

PILOT TUBE SOCKET

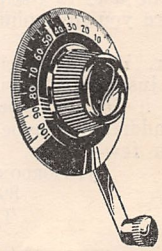
This tube socket submitted to the RADIO NEWS LABORATORIES for test by the Pilot Electric Mfg. Co., is very well made and has the added feature of having the ends of the spring contacts roughened so as to make them self-cleaning.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 988.

MAZADA DIAL

This dial was submitted to the RADIO NEWS LABORATORIES by the Mazada Radio Manufacturing Company, 3405 Perkins Avenue, Cleveland, Ohio.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 924.

MEISTERSINGER LOUD SPEAKER

This loud speaker, shown in the illustration, was submitted to the RADIO NEWS LABORATORIES for test by the Tower Mfg. Corp., 98 Brookline Avenue, Boston, Mass. It gives very fine reproduction with regard to both quality and volume. It is well made and attractive in appearance.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 990.

Correspondence from Readers

Each month readers of RADIO NEWS *give their praise or spleen regarding current happenings or opinions in the radio field in these columns. Many interesting verbal battles are fought on this page.*

ANOTHER INVALID EXPERIMENTER

Editor, RADIO NEWS:

In the September issue of RADIO NEWS is an account by Thomas J. Howells, entitled "An Invalid Experimenter." I have just finished reading it for the third time and, as you say, it has put new life into me. I, too, am among the unfortunates who are laid up, and that is why I fully realize what Mr. Howells has accomplished.

I am away behind the times in radio. I am still using a honeycomb coil outfit, but I have hopes of some day catching up to the super-heterodyne era. It is one awful job trying to keep up with the times when one is not able to get around.

I wonder if the radio fans (I mean those physically normal) can understand in the least just what a job it is to build a set, or even work at one, while in bed. Our friend, Mr. Howells, deserves a gold medal for being so modest about it. There are a hundred and one things which can happen to "get your goat." I remember one day I was mounting some apparatus on a board and I wanted a small brass screw. I lifted a box of assorted screws over onto the bed to pick one out and just then my arm slipped and I spilled the whole box in the bed! If you think it's a joke, just try it.

I use dry cell tubes, UV-199's, and find them very good. (Besides, my friends can come and see me without the dread of being asked to carry out my storage battery to have it charged!) The one great drawback with the radio game is the fact that the doctor pays more attention to the radio junk than he does to the patient. However, I will spare you my opinion of the medical men.

Now, sir, if you haven't any room for this letter, just chuck it, but I should greatly appreciate it if you would send me Mr. Howells' address; maybe he and I could exchange a few letters.

J. GORDON EDINGTON,
89 Glouster St.,
Toronto, Canada.

A PLEA FROM RUSSIA

Editor, RADIO NEWS:

Russian amateurs will have a friendly correspondence and more close acquaintance with you! Please send along letters. I wait! If you can please send me some radio books and magazines and different radio parts, for all I'll be sincerely thankful you, and may give, if you want, Russian post-stamps and paper-money, emited during a revolution and post-cards with Russian views.

With each letter please enclose, to help me pay postage, some International reply coupons, on amount 30-60 cents. All letters and sendings send only by *registered post* to

A. KALACHNIKOFF,
Tomsk, Siberia, Russia,
Krasnoarmeiskaja St. 66.

ABOUT THE THREE-RANGE RECEIVER

Editor, RADIO NEWS:

I have built the three-circuit three-range receiver described in RADIO NEWS for July, and to say that the results are gratifying is to put it very mildly.

The volume with two stages of audio is tremendous. I receive stations in Kentucky, Missouri and Texas with volume enough to be heard all over an eight-room house. And the selectivity is excellent.

I have a five-tube neutrodyne also, but I prefer the three-range set. Of course, the neutrodyne is more quiet. But the three-circuit three-range set is surely a distance-getter.

Here is a little trick that I find very useful: If the outside plate of a variable air condenser is advanced about a quarter of an inch it will give quite a vernier effect. Perhaps some of the fans might be glad of this information.

If you should care to publish such information, I will write you again, giving some records which I have achieved with this wonderful set.

WILLIAM RAMEY,
R. R. No. 3,
Cadillac, Mich.

WELL, WELL!

Editor, RADIO NEWS:

I seen your International Radio in one October RADIO NEWS and will you tell me how she works, the Inglish book condenser with the vernier knob k the which has a finer tread (thread?) than what N has yet the both which work off the same skrew shaft ain't it?

I wouldn't bother you like this onli my invalid grandmother (shes the one thats 102 and smokes a pipe in the rotogravure sections of the newspapers) says nothin ever fazed her until this come along and shes had a lotta love affairs too pop tells me and she wants to know how knob k works on the skrew shaft when it has a smaller tread. Yours trooly,

OSKAR WILD.

BRITISH VS. AMERICAN RADIO

Editor, RADIO NEWS:

I have followed the correspondence on the above subject with great interest, and as a British operator of long experience, very familiar with both American and British radio, I should like to be permitted, through the medium of your excellent magazine, to draw attention to a few considerations which have been overlooked by your correspondents

Comparisons were ever odious, and it is practically impossible to make comparison between British and American radio when the conditions in the two countries are so vastly different. In view of this, it is regrettable that Mr. Bayes, your British correspondent, should have expressed himself so forcibly. I am sure that had he not overlooked a few points, he would never have done so.

In any case, Mr. Bayes, hard words never lead one anywhere in a discussion of this sort. In fact, they only lead to individual international bad feeling, which is to be deplored.

Mr. Howe, in your May, 1925, issue, describes reception conditions on this side of the Atlantic, and on the European side, and his statements are quite correct, as far as they go. However, it is a fact that the United States generally is blessed with better receiving conditions than is Great Britain. Why this is so I do not know, but after very many years of observation I can testify to that effect.

Mr. Howe says that he can see no reason why British stations should not carry as well out into the Atlantic in a westerly direction as American stations do in an easterly direction. Neither can I, but I believe Pacific Coast stations are regularly picked up on the eastern seaboard of America, whereas eastern stations are very seldom heard on the Pacific Coast. Can Mr. Howe explain that?

Signals undoubtedly do seem to travel better in an easterly direction, this fact having been noted long before the days of broadcasting. Difference in time undoubtedly has something to do with it. By the time it is dark enough in the West to get best reception conditions, the eastern stations have closed down.

Best reception conditions do not set in till about 10 P. M. local time (roughly), so that when Mr. Howe was attempting to receive British stations at a distance of some 1,500 miles to the westward, he would be in approximately latitude 35 west, where the time is two hours and twenty minutes behind Greenwich. As the British stations sign off at about 10:30 or 11 P. M., the latest time (locally) that he could listen for them would be about 8:30 or 9 P. M., when best reception conditions have not yet had time to become fully established. The same remarks apply to any attempted reception of eastern stations on the Pacific Coast of the United States.

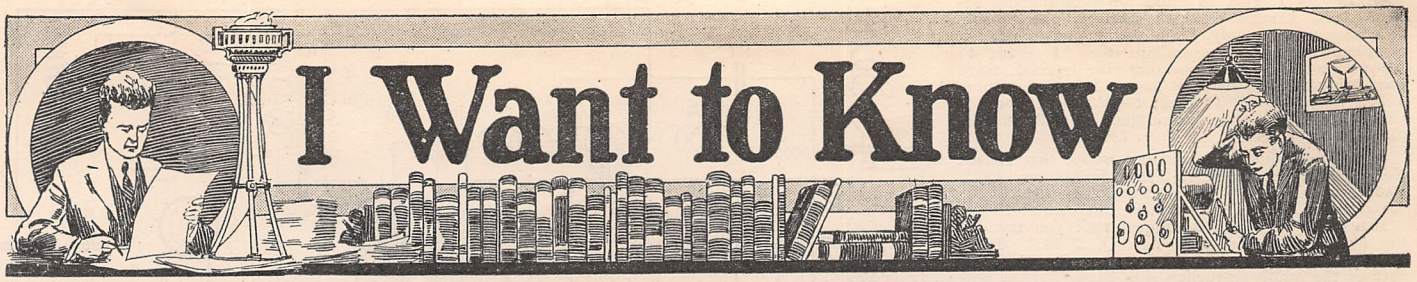
Many observers who attempt to compare receiving conditions in various parts of the world forget this all-important time factor, which, though it does not explain everything, is, nevertheless, a factor of considerable importance.

What of the reception of British stations to the *eastward* of England? Has Mr. Howe tried it? Personally, I have not been very far east since the introduction of broadcasting, but observations in various parts of Germany, 600 or 700 miles east of England, have shown me that the B. B. C. stations come in many times stronger than they do to the westward. The results, in fact, are roughly comparable with those obtained at a similar distance from the eastern American stations. Reports coming from Egypt, Russia, India and other places in the Orient, indicate that the British stations are received in the East with a degree of regularity and strength comparable with the reception of American stations in Great Britain, which seems to confirm my contention that signals travel best in an easterly direction.

Mr. Howe is puzzled on the question of the power used by British stations. This is excusable, and right here lies one of those points of difference which make comparison so difficult.

In America, broadcasting stations rate their power in accordance with the amount of power actually put into the antenna; that is, power *output.* In England, on the other hand, power is rated according to the *input* power of the generating plant, and includes the power absorbed by auxiliaries. The Western Electric 500-watt radiophone equipment, for example, obtains its power from a 5-kw. motor generator, which feeds all the auxiliaries, filaments, etc., connected with the set. In England, such a set would be called a 5-kw. transmitter.

A. DINSDALE,
Senior Operator R.M.S.P. Orduña,
Member of the Radio Society of Great Britain.



Conducted by R. D. Washburne

THIS Department is conducted for the benefit of our Radio Experimenters. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent. Please make these questions brief.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

Mr. Washburne answers Radio questions from WRNY every Thursday at 8:30 P. M.

DE FOREST F-5 RECEIVER

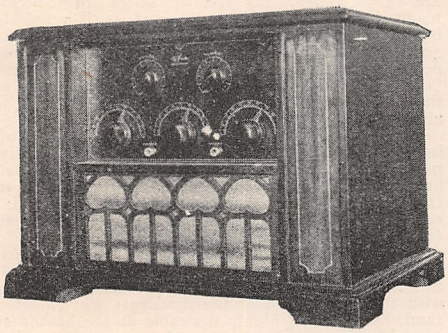
(2147) Mr. E. Schaefer, East Las Vegas, New Mex., asks:

Q. 1. What information can you furnish about the DeForest F-5 receiver incorporating two stages of tuned radio frequency, detector, and two stages of transformer coupled audio frequency amplification? Desire particularly to know the method used for preventing circuit oscillation, as well as any other general information you think would be of interest.

A. 1. All the information we have available on the circuit you mention is contained in the accompanying text and in the illustrations appearing in these columns.

It will be noticed that circuit oscillation is controlled by the resistances marked R-1 and R-2, which may be 400-ohm potentiometers. There is little adjustment of these units required after they have once been set for the particular tubes used in the receiver. Those desiring to pursue still further the subject of oscillation control are referred to the article, "Oscillations and How They Are Overcome," appearing in the May, 1925 issue of RADIO NEWS (pages 2083, 2084 and 2085). Circuits illustrating various methods of circuit oscillation control appear in the "I Want to Know" department of RADIO NEWS as enumerated below:

July, 1924, circuit Q. 958.
November, 1924, circuit Q. 2036.
December, 1924, circuit Q. 2055.
March, 1925, circuit Q. 2094.
March, 1925, circuit Q. 2099.
April, 1925, circuit Q. 2101.
May, 1925, circuit Q. 2109.
June, 1925, circuit Q. 2120.
July, 1925, circuit Q. 2126.
July, 1925, circuit Q. 2127.
July, 1925, circuit Q. 2130.
September, 1925, circuit Q. 2142-B.
October, 1925, circuit Q. 2144.
October, 1925, circuit Q. 2146-E.



DeForest F-5 receiver exterior appearance. Note built-in loud speaker (with opening, cloth and grill-work covered). A modern 5-tube set.

Still further means are described in the text answering questions numbers 2126 and 2127 (July, 1925).

It is evident from the photographs that the tuned radio frequency transformers are of the "astatic" type. That is, they do not possess an appreciable field. The value of the variable condensers will depend upon the inductance value of the secondary. It is hardly necessary to state exact construction "dope" for the transformers, since it would be merely a repetition of detailed data that has already appeared in these columns in a past issue of RADIO NEWS. See this information in the "I Want to Know" department of the October, 1925, RADIO NEWS, answer to question No. 2146.

The variable condensers used in the commercial receivers having the F-5 circuit are of .0005 mfd. capacity.

The first audio frequency transformer has a ratio of 5:1; the second, 3½:1.

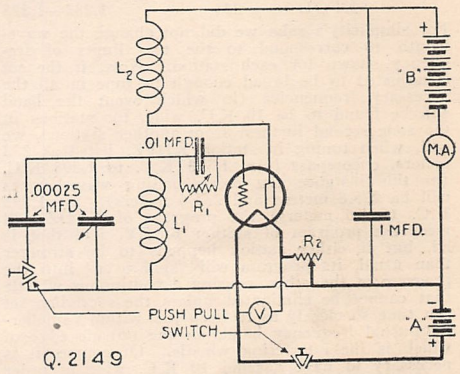
The aerial length has little effect upon the dial settings, as there is compensation by means of the three binding posts marked "S," "M" and "L," for, respectively, short, medium or long aerials. The recommended length is about 150 feet. This is the length of wire (it is wound on a built-in reel of aluminum), supplied with the "portable" model, F-5 receiver. A flexible ground lead 15 feet long is supplied. Complete with tubes and batteries, the weight is about 37 pounds. The model shown in the photographs is the "self-contained" model, not the "portable."

Shock-absorber sockets are used. Grid leak value will probably be about as usual—two megohms. The "C" potential required for the audio frequency amplifier grids is secured by utilizing the voltage drop occasioned by placing the rheostats in the "A" battery negative lead. This eliminates the need for a "C" battery, the patent on the use of which is held by the American Telephone and Telegraph Company, which, in turn, has licensed but a few companies to use the patent.

Q. 2. Would it be possible to apply regeneration to the oscillator-detector tube of the Tropadyne?

A. 2. Regeneration to a sufficient degree is automatically obtained in the circuit, due to the fact that an exact electrical balance is seldom struck when building the set.

Q. 3. On page 1679 of the March, 1925, RADIO NEWS was described "An Interesting Code Practice Method." Although I have tried this with 20 turns of number 30 D.C.C. wire, and also 30 turns, I cannot hear a hum with head-phones that function in a regular radio set.

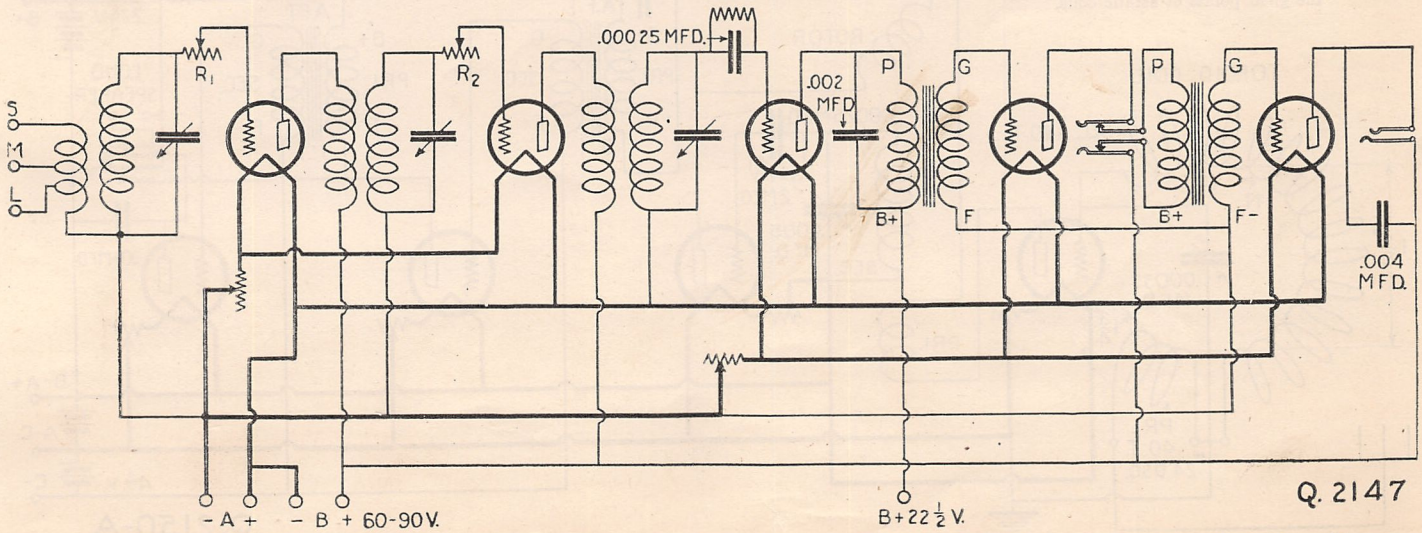


The "Buzzerdyne." An improved wavemeter. By peculiar electrical action, a pure audio note modulation is obtained.

A. 3. If your lamp cord is of "twisted pair" (two conductors, insulated and twisted spirally), place your wire, which may be regular insulated bell wire, so that it will lie in the spiral groove of the two lamp cords. Extend the bell wire so that it covers a lamp cord distance of three feet or more, binding with tape. If the lamp cord is "two-conductor, parallel," run your insulated bell wire parallel to the light wire for a distance of three feet or more, and bind to the light wire with tape.

ULTRA-SELECTIVE CIRCUIT

(2148) Mr. Robert E. Schultz, Newport, Ky., asks:



Schematic circuit of "Type F-5" DeForest radio set. Units "R-1" and "R-2" are termed "anti-radiation devices." They control circuit oscillation. Ground is connected to "A" minus. Grid and plate leads must be short, while battery leads may be bunched like a telephone cable.

Q. 1. As I wish to build an exceptionally selective set, a super-selective receiver, one capable of tuning very sharply, I am asking you to print a complete receiver diagram, in the "I Want to Know" columns, incorporating the special wave trap principle described on page 2252 of the June, 1925, RADIO NEWS ("Selector—A Tuner for the City"), unless you can suggest a still sharper tuning arrangement.

A. 1. You apparently did not notice that circuit No. 116 "Standard Hook-Ups," September, 1925, RADIO NEWS ("Selector—A Tuner for the City") features the type of connections you mention.

However, we wish to suggest that you try out the new circuit we show as "Q. 2148." It is claimed to be so selective that it will "chop off part of the audio frequency side band." If it will do that, it is selectivity PLUS! Let us make clear this business of "side bands" here in a few words.

The U. S. Government figures on a separation between stations of 10 kilocycles (20 kilocycles separation, however, when stations are situated in adjacent zones). This is a sufficient frequency band to encompass all the major frequencies encountered in radio music. Now, if the receiving set tunes more closely than 10 kilocycles, thus not using the full frequency band of 10 K.C. (kilo cycles), some of the higher notes will be excluded from the head-phone circuit, will not be heard, in other words, if the receiver tunes so closely as to eliminate some of the "side bands," or "end frequencies." Just how this applies in practical wave-length and frequency figures is shown below:

	Call	Meters	K. C.
	KFDZ	231	1,300
(A)	KFEY	233	1,290
	KFOL	234	1,280

That is the way the stations look in the call book. Here is how they tune in the set:

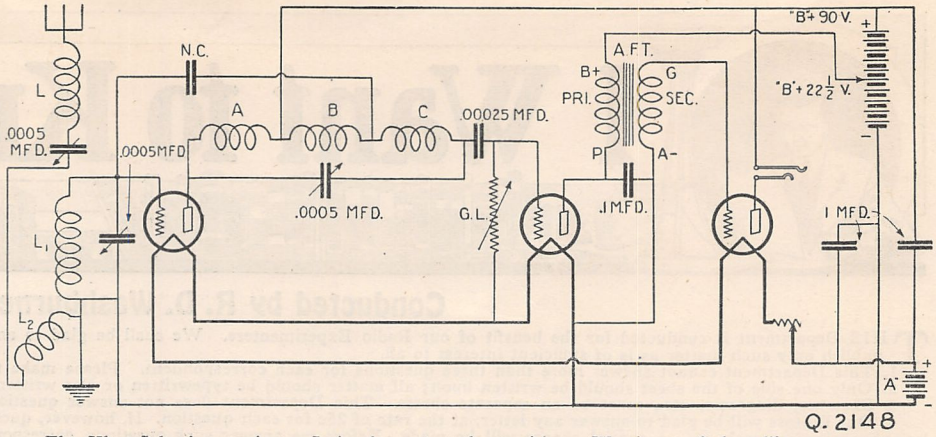
	Call	Meters	From—K. C.—To
	KFDZ	231	1,305—1,295
(B)	KFEY	233	1,295—1,285
	KFOL	234	1,285—1,275

For simplicity's sake we did not change the wave-length to correspond to the two limits of frequency shown for each station. Now, if the set is adjusted to be broad enough to tune in all the necessary frequencies (in which event the band will be found to be 10 K.C. wide, for stations in the zone second furthest from another station), we will, when tuning in station KDFZ, listed as 233 meters, encompass from 1,305 K.C. to 1,295 K.C. (in this instance the corresponding wave-lengths will be 229.8 meters and 231.6 meters). At 1,295 K.C. (231.6 meters) the program of KFDZ will meet the program of station KFEY, and that is all, but if either station happens to be stronger than usual, its program will "spill over" into the program of the other, causing a continuous whistle that cannot be eliminated unless the receiving set can tune so closely as to keep just within a smaller-than-usual frequency band, on the outside edge of which is the interfering whistle. Of course, it is necessary to have a band 10 K.C. wide in order to have good quality reception, and some distortion results (frequency distortion) from making a super-sharp set, such as this one, respond to an 8 K.C. band only, but we have eliminated the continuous "heterodyne" whistle which was more objectionable than the distortion we must put up with to eliminate it. Some form of vernier condenser adjustment is an absolute necessity.

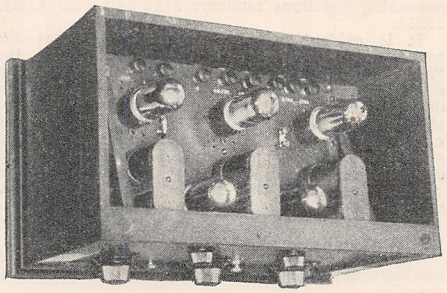
The value of the fixed condenser from the detector plate to "A" minus should be varied to determine best value. This is extremely important.

Detector grid leak may be variable, or two megohms fixed.

Western Electric "N" tubes are preferable in the design shown. WD-11 or WD-12, C-11 or C-12, or equivalent tubes could also be used with this series arrangement of the filaments. (Should it be necessary to say that the "A" potential must be about equal to the sum of the terminal voltages of the tubes used, plus one or two volts more for overcoming connecting wire and rheostat resistances?) It is up to the experimenter to adapt the circuit to the use of other tubes, such as those of the storage battery type, than the ones listed above. Any deviation from the plans given would be experimental and any forecast of results would be purely theoretical, as no variations have been tried as yet by our laboratories. An additional stage or two of audio frequency amplification may be added in the usual manner. (Only a push-pull power amplifier should really be used.) Care must be exercised in the transformer selection, or one of the big features of the set, excellent quality, will be lost. As shown here, the receiver may be used as a standard of comparison of the qualities of other sets, for it is hard to beat this one when properly built.



The Ultra-Selective receiver. It is also extremely sensitive. We do not feel at liberty to state maker's name. This is a REAL circuit. Any type of audio frequency amplification may be used, but it cannot be too carefully designed.



A bird's-eye view of one of the sets incorporating the F-5 circuit described in these columns, showing coil and tube-socket layout.

Compare detail Q. 2148-A with Fig. 2 appearing on page 532 of the October, 1925 RADIO NEWS. This sketch is in the article, "A New Super-Heterodyne." Here the author gives credit to Jackson Pressley for use of the bridge principle. However, readers are urged to compare the Pressley circuit, which is shown in the "I Want to Know" department of the February, 1925, issue of RADIO NEWS, as circuit Q. 2086, with the Tropadyne circuit fully described in the August, 1924, issue of RADIO NEWS.

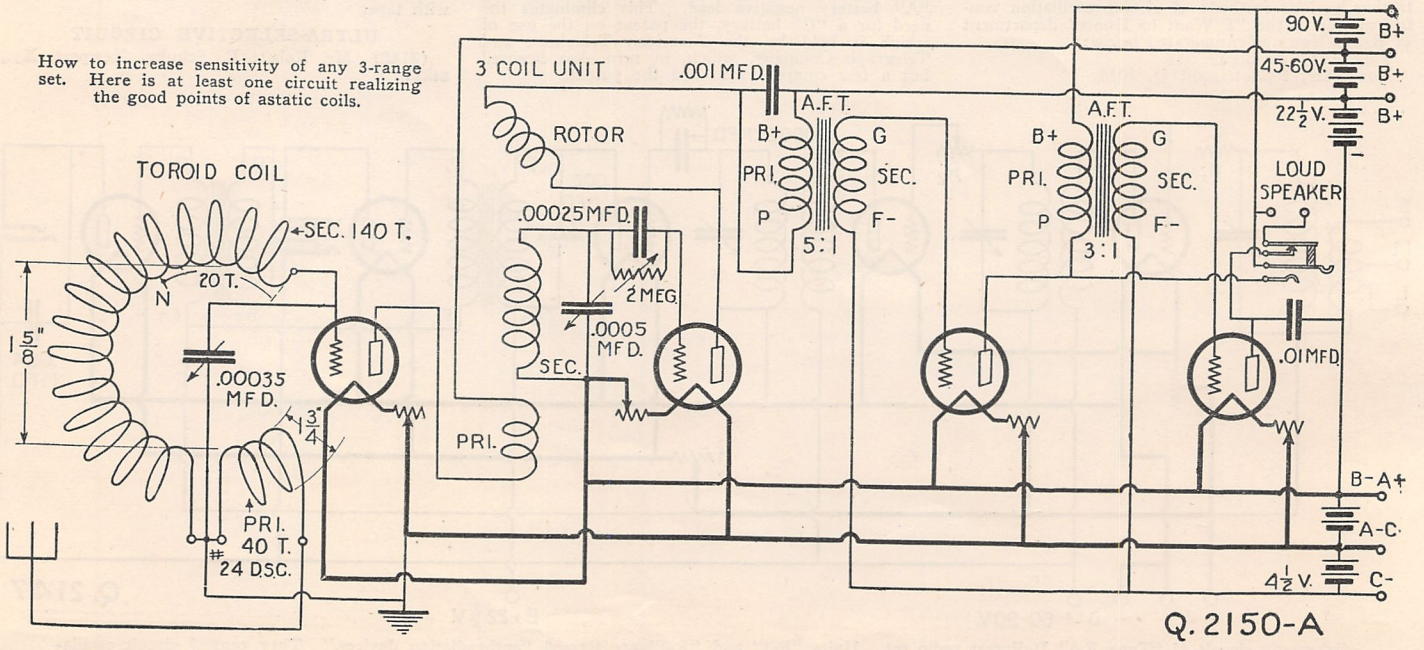
From a study of detail Q. 2148-A it becomes evident that in Q. 2148 we have what is probably the finest radio circuit ever offered to the broadcast listener. It is a pretty application of that super-delicate balance, affectionately recalled by every old-time worker in the field of electricity, still indispensible, still known throughout the world as the "Wheatstone Bridge." It is a system whereby two fixed "knowns" and one variable, calibrated "known" are balanced against an "unknown." When, through a series of delicate manipulations (that is, when used as it regularly is, in an ordinary electric circuit; and, I assure you, for accurate results the manipulations are delicate), a "balance" is struck, the value of the "unknown" is determined by reading the value of the variable, calibrated "known," since one will be absolutely equal to the other.

The slightest upsetting of the balance causes an instantaneous and amplified indication of the disturbance. In Q. 2148 the resistance of the dotted line condenser (the grid-plate capacity of the radio frequency tube) varies and instantly winding "C" responds and actuates the detector tube grid (through the grid condenser, of course).

In no other circuit has it heretofore been possible to have tuned impedance coupling between two tubes, with the plate circuit resonating exactly with the grid circuit at the broadcast wave-lengths (and, be it noted, highly desirable at the broadcast wave-lengths), without a resulting circuit oscillation of a highly undesirable character—what we all refer to as "howling." Now, on the other hand, it becomes possible to take advantage of all the little tricks of circuit operation well known to the experienced investigator, while heretofore they could not be, as a circus man would phrase it, "all brought together under one tent." To be sure, tuned impedance has been used in broadcast receivers, but what was necessary to keep the circuit from "howling"? Why, it was necessary to introduce a "loss" of some sort, and when we were

(*Continued on page 642*)

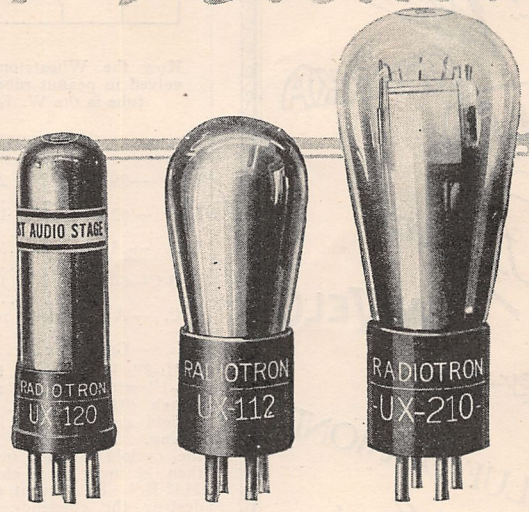
How to increase sensitivity of any 3-range set. Here is at least one circuit realizing the good points of astatic coils.



RCA *announces* three new power tubes *for greater volume*

RCA, concentrating great efforts on the study of vacuum tubes, has developed three important new Radiotrons. They will be widely used in sets of all kinds in the last stage of audio frequency amplification. Their contribution to radio progress is *greater power*. They mean greater volume on dry batteries—and greater volume on storage batteries. They mean better tone, because they mean volume of sound *without distortion.*

These new Radiotrons are now ready for general sale, after months of testing.



UX-120 UX-112 UX-210

Radiotron UX-120—*A new, powerful amplifier tube that means great volume of tone on dry batteries.* **$2.50**

Radiotron UX-112—*A new power tube similar to the familiar UV-201-A, but several times as powerful.* **$6.50**

Radiotron UX-210—*A super-power tube, several times as powerful as UX-120. Probably the most powerful receiving tube in existence.* . . **$9.00**

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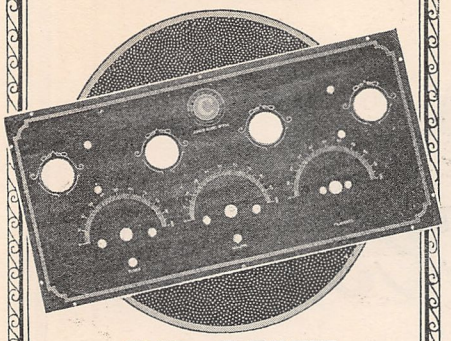

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I Want to Know

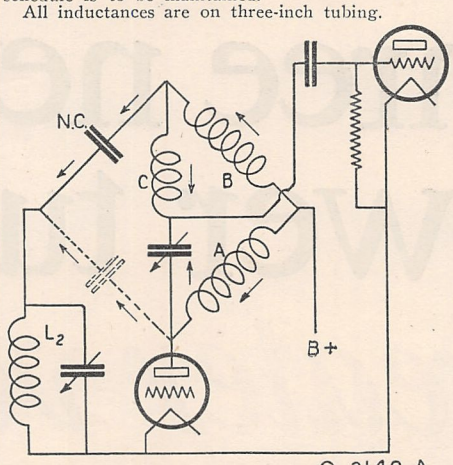
(*Continued from page 640*)

through "lossing" the circuit, there was about as much snap in it as there is in a saturated dish rag! On the contrary, in the circuit described the most efficient apparatus obtainable can be used and, in fact, are highly desirable.

A reference. Compare Q. 2148 with "Fig. 7," page 2085 ("Oscillations and How They Are Overcome"), of the May, 1925, RADIO NEWS. A practical application of Fig. 7 is the Roberts circuit clearly shown as Q. 2120 in the "I Want to Know" department of the June, 1925, issue of this magazine. In this circuit the detector grid coil is *inductively* coupled to the plate circuit of the radio frequency tube: in circuit Q. 2148 the coupling is *conductive*. Many of the ramifications of the neutralization principle are shown and discussed in "Anti-Regenerative Amplification," an article written for the January, 1925, issue of "QST" magazine by Dr. L. M. Hull. Note the similarity between "Fig. 3c," page 14, and "Q. 2148."

There is much more to be said, but space is limited and we must haste to our other queries, if schedule is to be maintained.

All inductances are on three-inch tubing.



Q. 2148-A

How the Wheatstone Bridge principle is involved in peanut tube circuit "Q. 2148." This tube is the W. E. 215-A, or "N" tube.

CONSTRUCTION DATA

Unit		Coil Length
L	—90 turns No. 24 B. & S. gauge D.C.C.	4½ inches
L-1	—60 turns No. 18 B. & S. gauge D.C.C.	4½ inches
L-2	— 5 turns No. 18 B. & S. gauge D.C.C.	¾ inches
A-B-C	—60 turns No. 18 B. & S. gauge D.C.C.	4½ inches
N.C.	—A regular neutralizing condenser	
G.L.	—Grid leak	

"L-2" is arranged to slide across one end of "L-1" with a cycloid motion as shown in "A" of sketch "Q. 2148-B." Coupling variation in the cycloid coupler (L-1, L-2) controls sharpness of tuning. The primary and secondary windings of the cycloid coupler must not be separated more than ⅛ inch, as is clearly shown in "A" of "Q. 2148-B." To prevent energy feed-back that would destroy the efficiency of the set, it is suggested that the experimenter use the coil layout in "B" of "Q. 2148-B." This is important.

"A-B-C" constitute a single-layer winding tapped at the twentieth and fortieth turns.

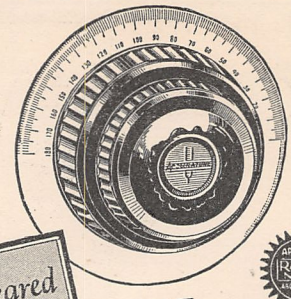
(2149) Mr. P. R. Spierling, Little Rock, Ark., asks:

Q. 1. Why is it that a neutrodyne with three stages of radio frequency amplification has not been put on the market? Would such a (6-tube) set be a success?

A. 1. We consider your inquiry very interesting. Sets having more than two stages of radio frequency amplification are available, but there are no neutrodynes among the lot. Some of the points are:

1. Two stages require three dials; three stages, at that rate, would necessitate four dials! Take too much time to tune. One-dial controls are easy, in the laboratory. When it comes to commercial production, we have "an equine of a differing hue." A two-dial arrangement might prove practical, after a great deal of experimentation, but there would be plenty of work before the set was ready for the public. It takes a mighty good one-dial set, where the one dial operates two controls, to equal a 2-dial set where either dial has but one control.

2. Some current supply units will work well with five tubes but poorly on six. Too, the sixth tube means added expense (the tube price) and battery consumption (if batteries are used) would be more. One more tube means one more place for trouble.



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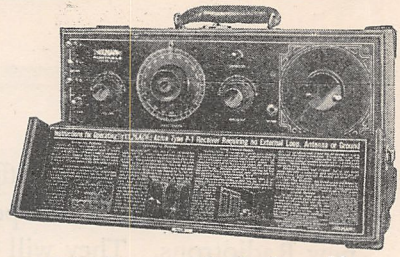

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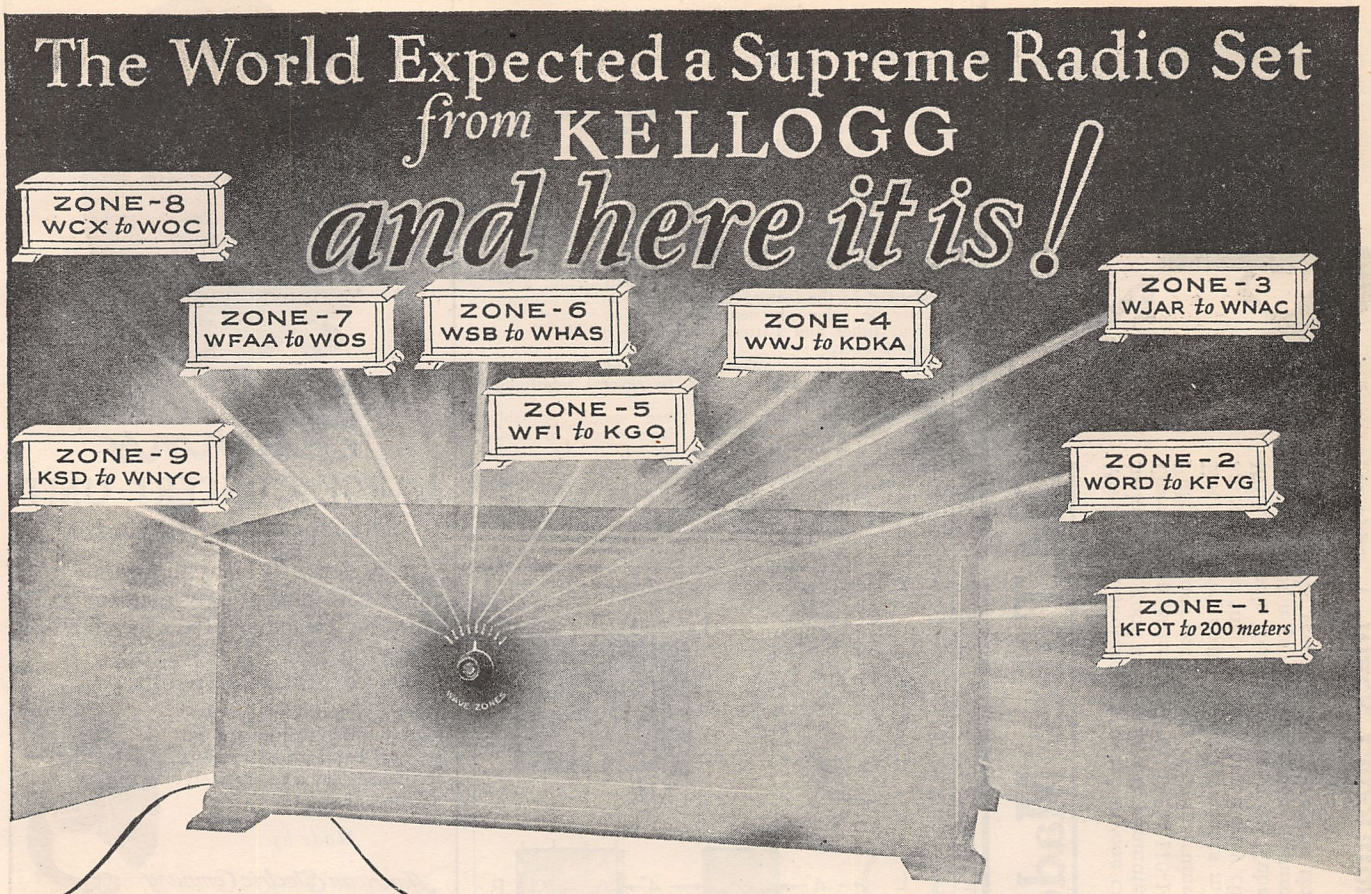

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Standard Model
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WAVE-MASTER
Brown Walnut Console with inbuilt horn
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Kellogg — for 28 years makers of precision telephone instruments and equipment — producers of quality parts since radio began — Kellogg has perfected a radio receiver worthy to bear the Kellogg name.

In the illustration we visualize this wonderful engineering achievement.

In the new WAVE-MASTER there are nine separate circuits—one for each 40 meter wavelength band. Each circuit gives that maximum efficiency heretofore found only in one short section of the dials of ordinary radio frequency sets. Each circuit brings within the range of the tuning dial *a different group of stations.*

How wonderfully simple tuning becomes! Merely set the pointer to the wave zone in which you are interested and bring in the desired station with the single Selector dial.

This remarkable tuning dial actually has a tuning range of 540 degrees—equal to 1½ times around a complete circle — over three times the station finding range of any other set.

All other radio frequency sets have variable capacity which must be tuned, usually with three different dials, to balance with their inductance coils.

The WAVE-MASTER'S inductance is not fixed but variable and is easily and quickly tuned, with the one Station Selector dial, to balance the fixed capacities.

Write for full description and complete technical explanation of the Wave Master circuit. Please mention your radio dealer's name.

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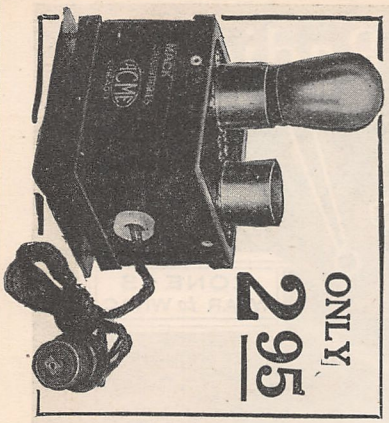

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Old Tubes Made Good As New

With this Laboratory product anyone can recondition old, run down Tubes and make them good as new in a few minutes' time.

Operates on either A.C. or D.C., 110-120 volts—simple, efficient and practical. Full directions accompany each instrument.

Reconditioner costs only a few cents more than a new Tube. Absolutely guaranteed to do the work or your money cheerfully refunded.

With a Mack Reconditioner your Tubes are all working to full capacity. No more ruining a good evening's programme on account of one or two faulty Tubes. Tubes can be reconditioned time and time again. Pays for itself in one evening.

A-Type | Mack Laboratories : Chicago | 199-Type

MACK RECONDITIONER

Our Guarantee Protects You

MACK LABORATORIES
724 Cass St. Chicago

Gentlemen: Inclose $2.95 check or money order (stamps not accepted), please send me the Mack Tube Reconditioner postpaid—on your guaranteed refund plan.

Name.....

Street.....

Town.....State.....

Check type of tube you desire Reconditioner for:
☐ A-Type
☐ 199-Type

3. Tube noises would be more pronounced. Detector tube would often be overloaded, resulting in distortion. Audio amplifier would have to be a wonder to be really efficient, if the set were to include two stages of audio, for both tubes and transformers would have a terrific load when locals were operating.

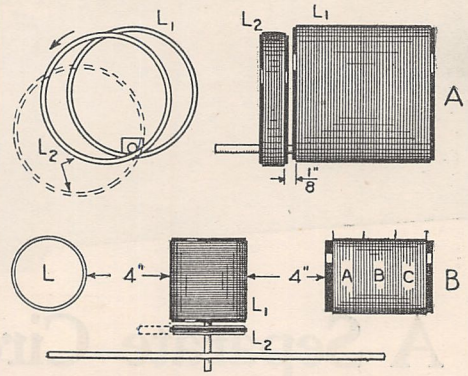
4. If set is made on low-loss lines, one would have to put a "ring door-bell" sign out, and hope the signals could read, for the selectivity would be so high it would take considerable time to tune in wanted signals originating at a distance of more than, say, 150 miles. Anyone who has tuned a neutrodyne can appreciate this.

5. Every stage requires neutralization. This is (more or less) easy to do at home, given all the time, knowledge and patience necessary for success. But to do this rapidly and certainly in production is an entirely different matter. Then again, a set balanced in the factory test rooms would not necessarily be balanced (neutralized) when entirely different tubes and batteries are used by the broadcast listener.

6. There is the amount to be added to the purchase price of the set, due to several additional production costs.

Considering everything, there would probably be a sale for a set having three stages of radio frequency amplification, neutralized, if the above stated objections were overcome. The most important point, two points we should say, would be to (a) keep down the number of tuning controls and (b) have a resulting efficiency greater than could be secured by the use of a lesser number of tubes.

Q. 2. If a neutrodyne is assembled with parts made under license from the holders of the neutrodyne patent, can further royalties be claimed by anyone?



Q. 2148-B

Details of cycloid coupler, A-B-C unit, aerial load coil, and recommended instrument layout.

A. 2. The assembled set may be used for non-commercial reception, and all will be well, but a license and the payment of a royalty is required before the set can be sold (technically). However, there can be little harm, I believe, in disposing of one, or perhaps two, receivers of a certain type, just so the making and selling does not become a habit.

Q. 3. Please give circuit and necessary information for making a wave meter for calibrating receiving sets. Would like to have a wave meter designed for simplicity, as well as efficiency.

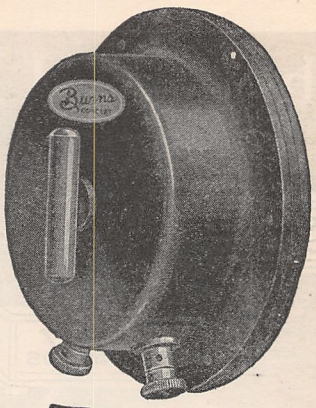
A. 3. We are pleased to describe to you the "Buzzerdyne," a development of an English experimenter, Percy W. Harris. You should find this instrument ideal for your requirements.

Essentially, we have a vacuum tube arranged in an oscillatory circuit (diagram "Q. 2149") and modulated at an audible frequency. The result is the radiation of a signal that may be received by any type of set and detected without the need of heterodyning, as would not be the case were the emitted signal an unmodulated one of radio frequency. The received signal is a pure whistle, of pleasing tone, which tunes "as sharp as a razor." In this respect, it is far better than a buzzer modulated type of wave meter, as the resonance point is much more pronounced, resulting in greater accuracy. Also, the Buzzerdyne is noiseless (as compared to a regular buzzer unit)!

First of all, we want to call attention to the paragraphs headed "Quick Change Coils," on page 2259 of the June, 1925, RADIO NEWS. If the range of the wave meter is not sufficient, as shown in the schematic circuit ("Q. 2149"), other coils may be made up, with the grid and plate coils on the one tube, and arranged to plug into a receptacle as shown in "Fig. 1" in the June issue just mentioned.

By using the push-pull switch shown, the variable condenser scale is "spread out," making it easier to secure an accurate reading. Two curves will be needed,—one for condenser switch *in* and one for switch *out*.

For ordinary purposes, L-1 may consist of about 50 turns of No. 20 or 22 enamelled D.C.C. wire wound on a 3-inch tube. Plate coil L-2 may consist of about 15 or 20 turns of the same size wire wound on the same tube, with a separation of about 1/16 to ⅛ inch between the finish of the grid winding (the filament connection) and the start of the plate winding (the "B" battery con-



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The Heart of the Speaker

Large size of this unit gives great range with tone of most pleasing quality which, combined with the amplifying properties of the Burns Horn, produces remarkable results.

Horn is of distinctive design with pyralin flare in several handsome finishes. It pleases the eye as well as the ear.

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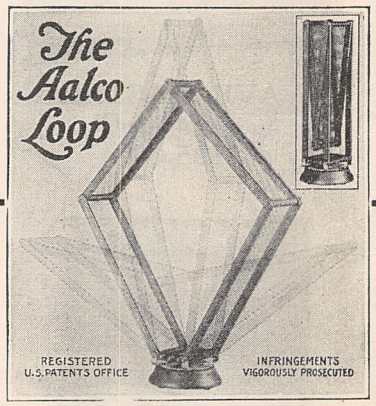

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THE AALCO —the lowest resistance loop made — assures maximum selectivity and range. Perfect dial matching made possible by variable inductance. Constructed throughout of the finest materials in a new and masterly design. Length, 24 in.—Normal Height, 30 in.—Wavelength range 120-600 meters. Laboratory test results sent upon request.

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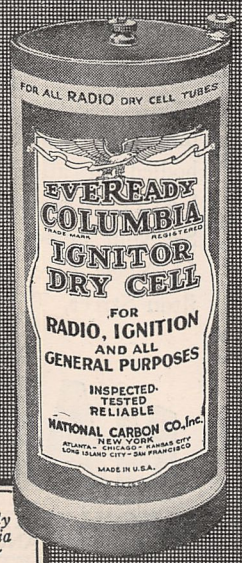
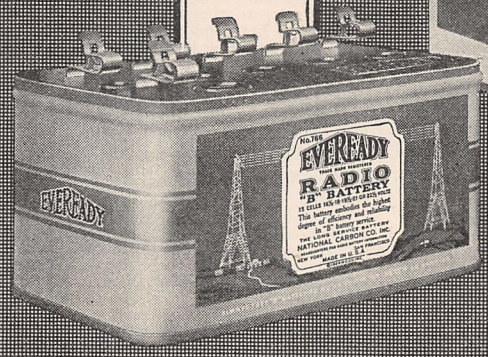


Eveready Columbia Ignitor "A" Battery, the proven dry cell for all radio dry cell tubes 1½ volts



No. 766 22½-volt Large Horizontal Price $2.00

No. 486 45-volt Layerbilt Extra-Large Vertical Price $5.50

There's Economy and Satisfaction

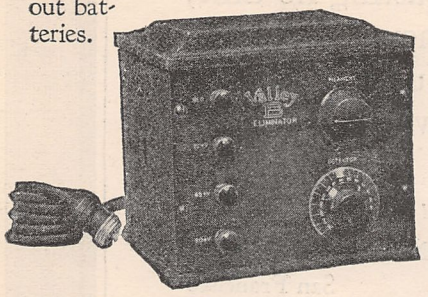
in these Valley units

You will find both economy and satisfaction in the use of the Valley B-Eliminator and the Valley Battery Charger.

Economy in the B-Eliminator because it stops forever the expense of buying new B batteries. . .

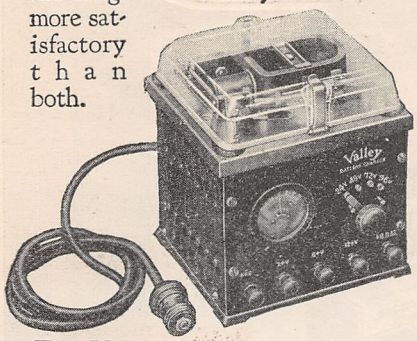
Economy in the charger because it recharges your own storage battery at home overnight at one-tenth the cost of service station charging. . .

And satisfaction in both because, by using them, you need never miss a program on account of low or worn-out batteries.



THE VALLEY B-ELIMINATOR operates from ordinary light socket; provides a steady, noiseless flow of B current *at a constant voltage all the time.* With it, there can never be any decrease of signals or frying noises due to low B batteries. Volume is maintained. Reception is uniformly good.

For receiving sets of from one to eight tubes. Costs less at the start than wet B batteries. Costs less in the long run than dry cells. Much more satisfactory than both.



THE VALLEY BATTERY CHARGER is the only charger needed for all radio storage batteries. Its correct 6-ampere charging rate makes overnight charging a possibility.

The Valley Charger also functions on any lamp socket. It takes about a dime's worth of current for an average charge. Quiet in operation.

Most radio dealers handle the Valley B-Eliminator and Valley Charger. Any one of them will be glad to show you these units and explain their advantages.

Radio Division
VALLEY ELECTRIC CO. ST. LOUIS, U. S. A.
Branches in Principal Cities

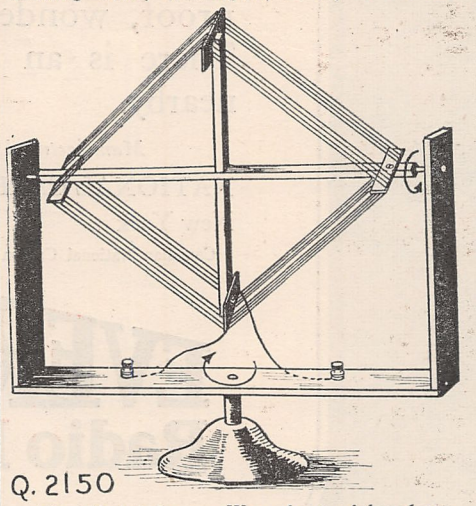
Valley Electric

nection; both windings in same direction). The imaginative radio bug may get the notion that a regular "air-core, tuned radio frequency transformer" could be used for the Buzzerdyne coil unit. Fine! Go ahead and use it. It is designed for the broadcast wave-lengths and will probably work "right off the bat," covering the full wave band, if the right tuning condenser is used. Warning! Do not make the mistake of using a toroid or other form of "astatic" coil. The things don't radiate, and we are depending upon the radiation from the coils to be picked up by the receiving set to be calibrated.

A storage battery tube is not needed for our Buzzerdyne. A dry cell one is O.K. The value of R-2 depends upon "A" potential and tube used. "V" is a high-resistance voltmeter reading 0—6. Correct reading is the "terminal voltage" of the tube used. "M.A." is a milliammeter reading 0—50. Neither is needed, except for completeness.

Grid leak R-1 is a Bradleyohm variable between 25,000 and 250,000 ohms. The use of such a leak value in conjunction with a .01 mfd. grid condenser results in the production of an audio frequency, which modulates the out-going radio frequency, due to what is known as "cumulative rectification," or periodical charge and discharge of the grid condenser, resulting in an audio note (if the action takes place at audio frequency). Various writers have explained the action. Scott-Taggart has described it very clearly (page 118) in his work, "Thermionic Vacuum Tubes."

The finished instrument may be sent to a testing laboratory, or it may be calibrated at home. In the latter event, one may write to the Government Printing Office, Washington, D. C., for the current issue of the "Radio Service Bulletin" (price, five cents per copy; twenty-five cents per year, of 12 issues). This contains a list of the broadcast stations sending on almost exactly the allotted wave. Other stations may be as accurate, but there is considerable likelihood otherwise. By using curve paper, and using the base line for dial numbers and left vertical edge for wave-lengths, dots can be placed on the horizontal and vertical line intersection where one of these "standard frequency" stations are heard, repeating the operation for each station in the list.



Q. 2150

The Gimbal Loop. Wave front of broadcast signal travels in vertical plane, while that of some forms of static is said to travel horizontally, enabling one to balance out either, optionally, with a gimbal-mounted loop.

I will make the operation a little more clear. Here is the way to go about it. Listen in on a regular radio set for a "standard frequency" station. When it is heard, turn to the Buzzerdyne and adjust its dial until you hear the Buzzerdyne whistle in the regular radio set. Now both set and wave meter are in resonance, and you are ready to mark your curve paper. After you have secured four or more different resonance points covering the entire adjustment range of the Buzzerdyne, join the dots with a smooth curve, and your buzzernote-autodyne wave meter is complete.

INTERFLEX HINTS

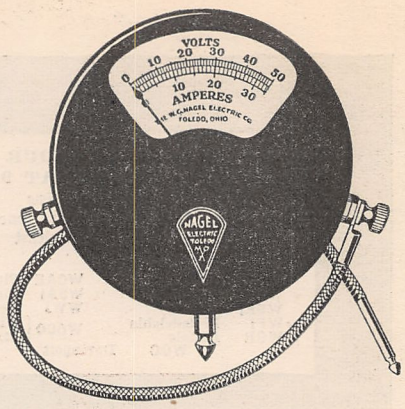
(2150) Mr. J. Sildman, Kew Gardens, L. I., asks:

Q. 1. What is a "Gimbal Loop"?

A. 1. A loop mounted on "gimbals," a form of swivel support permitting movement in any direction, allowing the loop to move in "azimuth" and "zenith." All this is made clear from a study of "Q. 2150." Two arrows indicate the motion. For broadcast wave-lengths, about 100 ft. of wire will be needed. Arrange the number of turns and their diameters in any convenient manner to assure using about this length of wire.

Q. 2. Please show, in the "I Want to Know" department of RADIO NEWS, the circuit mentioned by the editor of that department, Thursday evening, August 13, 1925, from station WRNY, to be given to all those who wrote to the station asking for it, and include all data for the first radio frequency coil described.

A. 2. The circuit mentioned was that of a standard regenerative receiver with two stages of audio frequency amplification, showing how to add



Every "Super-Het" owner needs this Voltammeter

Owners of Super Heterodynes or any other sets receiving their "A" and "B" current supply from dry batteries should have a Nagel Combination Voltmeter and Ammeter. Accuracy in readings under any condition and safety against battery drainage are two important features that are embodied in all Nagel pocket-type battery measuring instruments. See your dealer or write The W. G. Nagel Electric Co., 512 Hamilton Street, Toledo, Ohio.

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"Never seen 'er do *thet* before!"

A FARMER in Vermont was trying to sell his ancient mare as a spirited animal. He led her from the stable and was starting to put her through her paces, when suddenly she lay down, rolled over and died. The farmer was somewhat taken aback. "Well, well," he said. "Never seen 'er do *thet* before!"

Unfortunately there are radio receiving sets which bear a close resemblance to the old mare. They can often go through their paces. But at any time they are apt to need first-aid badly.

When you buy your radio, whether it is your first or your tenth, take this advice:

Look at it carefully, inside and out. See whether or not it looks to you like a clean, workmanlike job.

Hear it in operation. Then ask your dealer about the manufacturer. How long has he been in business? What is his reputation?

Do his sets need a lot of service after they are sold?

On a judgment of that sort, Atwater Kent is willing to stand or fall.

Hear the Atwater Kent Radio Artists every Thursday evening at 9 o'clock (Eastern Standard Time) through stations:

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WJAR . *Providence* WGR . *Buffalo*
WEEI . *Boston* WWJ . . *Detroit*
WFI . *Philadelphia* WOC . *Davenport*
WCCO . *Minneapolis-St. Paul*
WSAI . *Cincinnati*

Send for illustrated booklet telling the complete story of Atwater Kent Radio.

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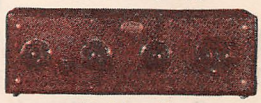
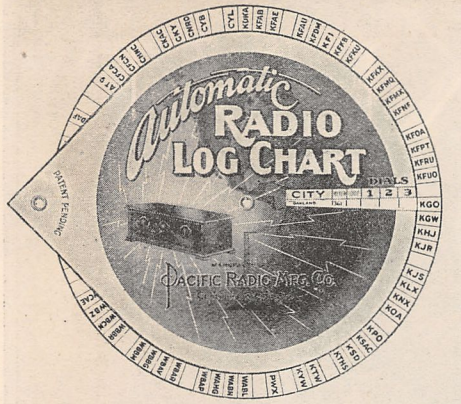


Model 20, $80

Model 10 (without tubes), $80

Radio Speakers $12 to $28

Prices slightly higher from the Rockies west, and in Canada.



How Often Do You Say "I'd Give a Dollar to Get That Station Again?"

Automatic Radio Log Chart

Efficiency is the keynote of Radio. Your set isn't efficient when you spend half the evening trying to locate your stations.

The Automatic Radio Log Chart enables you to instantly get any station you have ever heard before. The first time you get a station mark down the dial readings opposite the call letters of the station on the revolving disc. When you want that station again A TWIST OF THE WRIST gets your dial readings.

Space provided for logging 180 stations. Eastern stations on one side; Western and Canadian stations on the other. Blank spaces for entering your own local stations.

The Automatic Radio Log Chart is simple as A. B. C. Any child can instantly understand and operate it. Takes the guesswork out of radio and makes it a pleasure to tune in on any station you want to hear.

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SENT ANYWHERE IN U. S. ON RECEIPT OF ONLY **$1.00**

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Gentlemen—Enclosed is $1.00. Send Automatic Radio Log Chart to

Name .....

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City ..... State .....

a single stage of radio frequency amplification. The particular feature of the arrangement was the emphasis laid upon the method of preventing feedback by induction, the most troublesome form of feed-back in such circuits. The schematic circuit is "Q. 2150-A." A Circloid or similar coil may be used for the toroid shown, or it may be home constructed according to the directions given, just so it is of the "astatic" type of winding. The "Twin Cylinder" coil construction described in the "I Want to Know" department of the October, 1925, RADIO NEWS, page 480, may also be followed.

Astatic coils do not absorb energy (radiated, say, from the 3-coil unit), neither does it radiate energy (to the 3-coil unit). Upon a realization of this the astatic coil is seen to be the most desirable form of coil winding for the particular purpose for which it is here recommended.

The little tap marked "N" is not used. It is a Neutrodon tap for other circuits.

Circuit oscillation is controlled by varying the number of turns on the primary of the 3-coil unit. After the correct number of turns have been determined, there is no further change required in the constants of this unit.

Q. 3. Kindly tell me what precautions to observe in building an efficient Interflex set.

A. 3. We have listed below the points we have found of greatest importance in connection with the Interflex receivers.

1. It has been found that the All-American type R-201A and Acme type R-2 radio frequency transformers give exceptionally good results in the Interflex sets.

2. Try reversing the radio frequency transformer primary connections. Also, try reversing secondary connections.

3. A carborundum crystal is particularly good. Other kinds of crystals having rectifying properties can be tried, but they are not likely to give as good results.

4. Different carborundum crystals should be tried and reversing the connections sometimes makes a difference.

5. An aerial length of 65 feet, including lead-in, is excellent.

6. In the 4-tube circuit, the radio frequency, or first tube may have a plate potential of about 45 to 60 volts; the second tube, the one having its grid connected to the crystal detector (and therefore called the post-crystal tube) may have a plate potential of 22½ to 45 volts, for best results. The voltage for this (post-crystal) tube remains the same if the stage of radio frequency preceding it is not used.

7. When adding an audio frequency amplifier, a small condenser across the primary or secondary of the first audio frequency transformer may improve the operation.

8. Changing tubes around often results in a surprising improvement in tone, volume and selectivity.

9. The following Interflex articles have been published:

"The Interflex" (1 dial), RADIO NEWS, September, 1925.

"The Balanced Interflex" (1 dial), RADIO NEWS, October, 1925.

"The Interflex Receiver" (1 dial), *Radio Review*, October, 1925. *N. Y. Telegram*, August 29, 1925.

10. Note the effect of connecting a small variable condenser (about 5-plate size) from the post-crystal tube grid to "A" minus.

11. Fixed detectors are usually more rugged and are generally more satisfactory than adjustable ones.

12. Tune very slowly.

TOUGH!

First He: "How does your low loss receiver work?"

Second He: "It's a TOTAL loss!"

Contributed by Everett Shepard.

THE WORST IS YET TO COME

Europe is receiving American dance music by radio, and so far has been very decent about it.

Contributed by Frank Kitchell.

ETHERIAL LOVE

My mind becomes a vacuum tube
Whene'er I think of you;
My heart gets quite ec-static,
My head-band goes askew.

Your eyes that flash like unquenched sparks,
Your hair like copper wire,
Break down my high resistance
Like a transformed amplifier.

I really think we're both in tune,
And ere through life we roam,
Suppose you hook up now with me,
And share my humble ohm.

Contributed by Vernon F. Aspinwall.

You cannot buy a better machine anywhere or at any price than this latest "Master Model" Royal, No 10. It is, we honestly believe, the best typewriter made. You Save $53!

Like New in Looks and Service

Literally like new. Guaranteed for 5 years. Will give splendid service for many more. An all-around machine for letters, cards and billing. Has all late improvements, high-speed type bars, forced alignment, 2-color ribbon, with automatic reverse, tabulator, etc. Standard keyboard; 84 characters.

Satisfaction Guaranteed or Money Back

Try it 30 days. If it does not please you in every way, send it back at our expense and we will refund every dollar you have paid. Write for full details at once. A postcard will do.

Cut Prices On All Standard Makes

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James Blue Bullet FIXED CRYSTAL

Out-performs—Out-lasts—Looks better

Numerous tests have shown that James Blue Bullet will out-perform any fixed crystal for distance, volume and quality of tone. For an idea of its lasting qualities read this:

$1.00

"James Blue Bullet has been under 80 volts on the plate steadily for a month. Of other crystals, the first burned out in 8 hours and another in 15 hours. The Blue Bullet has outlasted them all and is still going strong."

Ask your nearest dealer for a James Blue Bullet or send to us direct. Postpaid or C.O.D., $1.00.

JAMES 2 Side Crystal **50c** Two Crystals in one. All sides sensitive.

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JASCHA GUREWICH "Saxophone Virtuoso"

BUESCHER True-Tone Saxophone

Easiest of all instruments to play and one of the most beautiful. Three first lessons sent free give you a quick easy start. In a few weeks you can be playing popular tunes. You can take your place in a band or orchestra in ninety days, if you so desire. Most popular instrument for dance orchestras, home entertainments, church, lodge and school. A Saxophone player is always popular socially and has many opportunities to earn money. Six Days' trial and easy payments arranged. (178)

Free Saxophone Book Shows all Buescher models and gives first lesson chart; also pictures of famous professionals and orchestras. Just send your name for a copy. Mention any other instrument in which you may be interested.

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974 BUESCHER BLOCK ELKHART, INDIANA

501-A Blue Special is for storage batteries only. $2.75 each

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Each sold on a restricted territory basis.

Each backed by comprehensive national and local newspaper advertising.

Sylfan Products are manufactured and marketed nationally by an organization of unquestioned integrity and financial standing.

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Kits of 5, $13.75

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are going to play a part of greatest importance this year.

Sylfan Matched Blue Specials

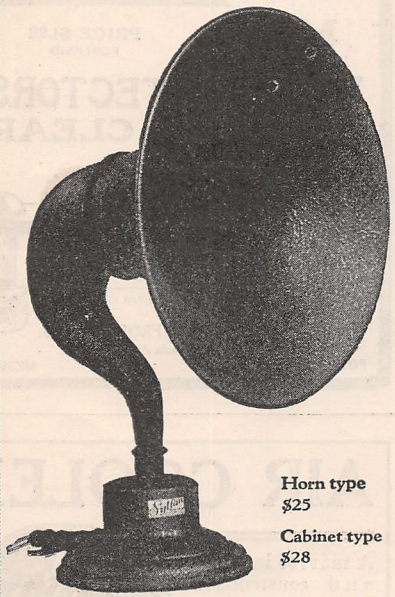
are without a peer, for quality, performance and long life.

Absolutely guaranteed. (Any tube that will light replaced without question.)

Sold in kits of three and five tubes and also singles (to match tubes in kits).

All tube adjustments are made promptly by Baker-Smith offices. Dealers and Jobbers are not expected or asked to make adjustments.

501-A Silver Tube for storage batteries.
499-A Peanut type standard base.
499 Peanut type.
$2.50 each



Horn type
$25

Cabinet type
$28

Sylfan Reproducers

are made on new scientific principles of recreation and amplification worked in such a way that every note of music—every tone and inflection of the voice is reproduced perfectly. SYLFAN is a speaker you will never be willing to trade. It stands comparison with the most expensive—sells for a sensible price.

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BAKER-SMITH CO., Inc.

New Call Building MANUFACTURERS **San Francisco**

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Salt Lake City	Atlas Building	Vancouver, B. C. .	179 Pender Street, W.

JOBBERS ARE INVITED TO ADDRESS OUR NEAREST OFFICE FOR FULL DETAILS.

Sylfan Receivers

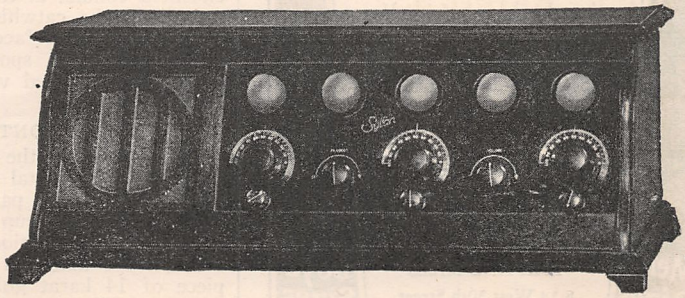
are eminently satisfactory in performance—handsome in appearance—sensible in price.

Engineering skill and craftsmanship of the highest type have combined to produce Radio Receivers truly remarkable for their tone quality and ease of manipulation.

Visit your dealer and ask for a demonstration. You are certain to be pleased. If his stock has not yet arrived, send your name and address to our nearest office and we will advise promptly where you can obtain Sylfan Products.

All Sylfan Receivers are housed in genuine mahogany cabinets—with cabinet room for batteries. You have your choice with or without speaker built-in.

Two and three-tube Sylfan Receivers employ the famous Armstrong regenerative principle of radio reception—Four-tube Sylfan combines Armstrong regenerative and radio frequency—while the five-tube Sylfan is tuned radio frequency alone.



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AMERICA'S GREATEST KNIT JACKET VALUE!

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IT'S worth broadcasting—the story of the Practicoat. Tune in on this manly garment and enjoy its comfort, its sturdiness, its good looks.

A chummy, friendly garment that fits snug and wears long. Only $5, too—and guaranteed to satisfy you.

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Manhattan
KNITTING MILLS
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New York City

Men's Sizes $5
Boys' Sizes $4

Getting the Most from Crystal Sets

(*Continued from page 629*)

sensitive as good galena. Furthermore, they do not offer as much field for experimentation and therefore we will not consider them here in detail.

MOUNTING CRYSTALS

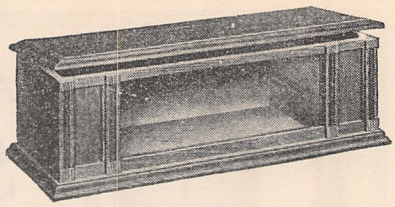
After a good piece of crystal has been selected, either by buying a quantity as mentioned above or by buying a few separate pieces, the next problem is mounting it so that it will make good contact with the electrode that is connected with the circuit and so that no losses will occur at this point. There are two efficient methods of performing this, one of them being a permanent mounting. The other provides for the changing of the crystal with the least trouble. Probably the best method of mounting crystals is the permanent method illustrated in Fig. 4A. This method consists of using what is known as a soft metal that has a very low melting point. Never try to use solder for mounting crystals in a cup because the heat at which it melts is so great that it will often destroy the sensitiveness of the crystal. This is one point that must always be remembered. Do not attempt to apply any great amount of heat to a crystal as it will often become useless after such treatment and cannot be restored.

To avoid this, a soft metal that melts below the temperature of boiling water should be used for a permanent mounting. Most radio stores carry this sort of metal in stock, but if you cannot obtain it easily, you can make it yourself. This can be done in several ways. One good alloy that melts at about 160° Fahrenheit consists of two parts of tin, 4 parts of lead and 5 to 8 parts of bismuth. This is known as Wood's metal. If you cannot obtain the bismuth or pure tin, you surely can obtain ordinary tinfoil and a small quantity of mercury. Dissolve the tinfoil in the mercury continuing to add the foil until no more can be dissolved. The dissolving process may be carried still a little further by kneading the mass in the hands and working the tinfoil into it. When it is absolutely impossible to get any more of the foil into the mixture, melt it and then pour it out on a piece of unvarnished board to cool. It may then be broken up into small pieces and when needed, melted again, poured into the cup and the crystal pressed into the surface just before the metal hardens. In this way, there will not be enough heat applied to the crystal to affect its sensitiveness in any way.

A semi-permanent method of mounting crystals is by employing an ordinary cup for mounting. One with comparatively thick walls should be selected, so that three holes can be drilled and tapped therein. Do this and then screw in three pointed thumbscrews, as shown in Fig. 4B. You can place a crystal between these three thumbscrews and tighten them up so as to make excellent contact at three points. Then you can apply the catwhisker or other contact to the exposed surface and can usually find a good sensitive spot. All sides of the crystal can be used when this mounting is employed.

CONTACTS

The subject of the contact that is to be used with the crystal and that is to be connected to the other part of the circuit from that to which the cup is connected, receives all too little attention. With galena, the best contact that you can possibly get is a piece of 14 karat gold wire of about No. 26 gauge. This can be coiled into a spring formation and the other end fastened in the detector stand. The other end is so arranged that it can rest lightly on the surface of the crystal and can be moved over the same.



Premier B Battery Cabinet

Our Premier B Battery Cabinet is a beautiful piece of furniture. The B battery compartment will take any type B battery. The space of each B battery compartment is 4½" wide, 8½" high and 10" deep.

No.	For Panel	Deep	Genuine Walnut
718-10	7x18	10"	$18.50
721-10	7x21	10"	19.00
724-10	7x24	10"	19.50
726-10	7x26	10"	20.00
728 10	7x28	10"	21.00
730-10	7x30	10"	22.00

F.O.B. Waukesha, Wis.

The tops of these cabinets are figured walnut, the ends and B battery panels are select walnut, all 5-ply veneer. The bases are built up of massive molding. Nickel plated piano hinges and lid holders. The material and finish in these cabinets will equal the best furniture obtainable.

We Make 9 Styles of Cabinets for 14 Sizes of Panels.

Send for our 1925-26 line of cabinets at "Factory to User" prices.

UTILITY CABINET COMPANY
WAUKESHA Phone 721 WISCONSIN

THE ATOMITE CRYSTAL FOR POWER & VOLUME

GUARANTEED

LOUD EVERYWHERE. A SIZABLE CHUNK——SENSITIVE ALL OVER. ATTRACTIVELY MOUNTED

PRICE 50c POSTPAID

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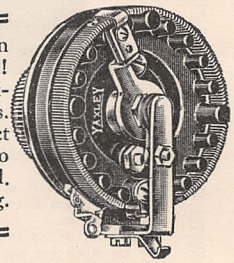
FIXED DETECTORS- ARE LOUD AND CLEAR.

PAT. APPLIED FOR

THE KEYSTONE PRODUCTS CO.
168 Gardenia Avenue,
ROYAL OAK, MICHIGAN

AIR COOLED

A marvel in design and construction! Coil air cooled, exposed on all sides. Adjustable contact sliding lever. No vernier required. One nut mounting.



At all good radio dealers
With Knob, $1.35
Etched Dial Plate, 15c extra

YAXLEY
APPROVED RADIO PRODUCTS

YAXLEY MFG. CO., Dept. N
217 N. Desplaines Street, Chicago, Ill.

Zenith was created for the home

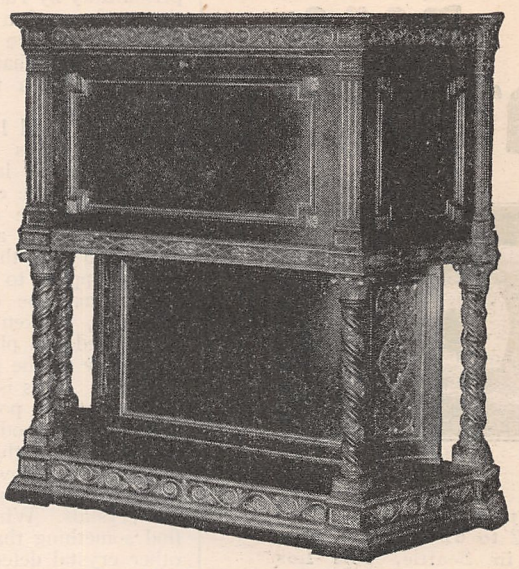
ALL one needs to get the finest radio results from Super-Zenith is good musical taste and a feeling for exquisite tonal values.

So far as *technical ability* is concerned, the Super-Zenith is so easily controlled that a child can bring in just as many stations—just as quickly—*each with the same clear quality of tone*—as a radio engineer.

Only a demonstration can make completely evident the remarkably selective character of the Super-Zenith—its clear, sweet tone—its thorough dependability.

Such a demonstration is yours for the asking—in your own home, if you so desire. Simply telephone your nearest dealer.

Again Commander Donald B. MacMillan chooses Zenith for his Arctic Expedition. When human lives may depend upon the reliability of radio performance, only one reason can explain his choice: Zenith has proved to be the best obtainable at any price.



Super-Zeniths are priced at from $240 to $2,000. Each instrument is sold under a quality guarantee. Above is shown the De Luxe Spanish model.

Super-Zenith VII . .	$240
Super-Zenith VIII . .	260
Super-Zenith IX . . .	355

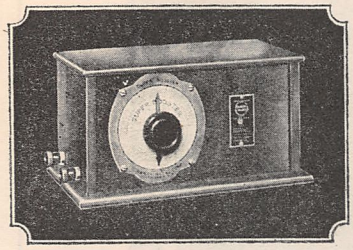
Also Zenith regenerative sets (non-radiating) licensed under Armstrong U. S. Patent No. 1,113,149

Zenith 4R	$100
Zenith 3R	175

Zenith Radio Corporation, *Straus Building, Chicago, Ill.*

ZENITH
TRADE MARK REG.
→LONG DISTANCE←
TRADE MARK REG.
RADIO

5 times more stations!



One man has raised his log from 12 to 62 stations! Another, in Seattle, gets Los Angeles in broad day-light! Better volume, sharper selectivity, freedom from disturbances, all are vouched for in hundreds of letters Super-Booster owners have sent us.

For selectivity it is positively unequalled. It cuts through interference like a knife, getting the station you want, strong and clear.

The Super-Booster employs an advanced, patented application of the principle of inductance not embodied in any manufactured radio set. Hence, with it, you can improve your reception no matter what kind of receiver you have.

It is a superbly executed mahogany cabinet, 9"x4"x5", placed on or near your receiver. It is very simple to operate and costs only $12.00! Thousands of Radio News readers have purchased the Super-Booster and these owners write us they would not be without the Super-Booster for many times its cost.

You should have it NOW. Ask your dealer. If he cannot supply, send a money order for $12.00 and we will ship direct, charges prepaid. Send your dealer's name.

Super Products
Manufacturing Co.
918½ South Vermont Street
Los Angeles, Calif.

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Various types of crystal detector stands that will adapt themselves to different contacts have been described in past issues of this magazine and no repetition is necessary here.

In lieu of gold wire, thin phosphor bronze wire may be used and gives excellent results. In any event, clean the point of the wire periodically by rubbing it once or twice over the surface of a piece of fine sandpaper. This will remove any oxide that may have collected and that may tend to make the contact between the crystal and the wire imperfect.

Another good little kink that often gives excellent results is the employment of a piece of pencil lead, sharpened to a point and used as the catwhisker. In doing this, the end of the catwhisker wire may be wrapped tightly around the pencil lead as in Fig. 5 and then the point of the lead may be applied to the crystal. Another good contact may be obtained with a piece of antimony, broken up until a small sliver is obtained and placed in the detector in the same way as the piece of pencil lead shown in Fig. 5. This is particularly suitable with silicon and the point should be so arranged that quite a good pressure can be obtained between it and the crystal. You can obtain quite a little knowledge from trying various contacts of this type with different minerals and crystals. Who can tell but that you will find something that may be of assistance to other crystal detector fans?

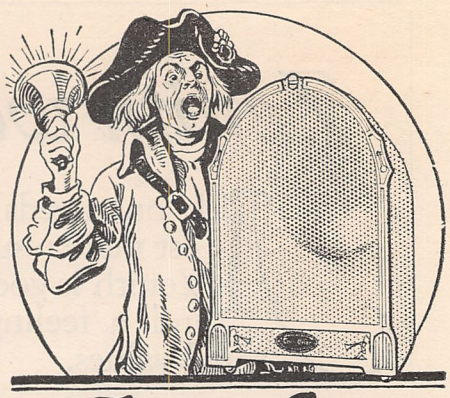
CARE OF CRYSTALS

As mentioned above in this article, crystals and minerals should never be handled with the bare hands, but tweezers should always be used. Sometimes, after a crystal has been in use for some time or after it has been handled with the bare hands, it will become rather insensitive. In such an event, pick it up in a pair of tweezers and wash it thoroughly in alcohol, using a soft toothbrush to scrub the surfaces thoroughly. This will remove any foreign matter that may have accumulated on the surfaces and will usually restore sensitiveness to a great extent. This is a little trick that is worth trying and should be remembered in all crystal work, as it applies to all types of materials that may be used for this purpose.

TESTING

Although there are many broadcast stations in operation today and it is very seldom that you will not have some station tuned-in, upon which you can test the sensitiveness of your crystal, still, when you are going over a quantity of material in search of a good piece, some sort of test that you can have under your control is to be greatly desired. The simplest way of accomplishing this is by using what is known as a buzzer test. This merely consists of one or two dry cells, a buzzer and a switch connected as shown in Fig. 6. The contact point of the buzzer is connected to the ground wire of the receiving set and no other connection to the latter is necessary. It is advisable to use a steady high-pitched buzzer as it makes testing much easier and more reliable. Furthermore, the buzzer should be so arranged that it does not make much noise, as otherwise it may bother you when testing. It can be packed in a small box by placing a quantity of absorbent cotton all around it. This will reduce the mechanical noise to a very great extent and often will render the buzzer almost silent in mechanical operation. All that you have to do to use this test is to close the switch, and listen in on the phones. If the detector is correctly adjusted, you will hear a loud buzz in the phones, but if it is not, move the catwhisker until such a sound is heard. The more sensitive the spot that is found on the crystal, the greater the volume of sound that will be heard in the phones. Thus you can quickly tell when you find an extraordinarily sensitive spot.

It may seem to some of the readers that a



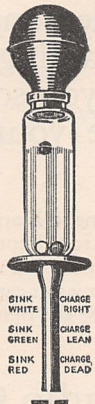
The TOWN CRIER
Radio's Most Beautiful Speaker

You will be delighted with the gorgeous colors . . . the handsome, stippled finish, and the novel design of the Town Crier—the Speaker with the voice that thrills. Ask your dealer to show you a Town Crier Speaker. Write today for beautifully illustrated circular describing the Golden Polychrome and Green Polychrome models.

List Price $17.50
West of the Rockies $18.50

GALE RADIO LABS.
2509 Irving Park Blvd. CHICAGO

SOS HYDROMETER



For Radio "A" and Automobile Batteries

SIMPLE — DURABLE ACCURATE

Easy to Read and Ready to Use

The patented Chaslyn Balls show the condition of your Battery.

Swim all THREE, Charged FULLY,
Sinks the WHITE, Charge still RIGHT,
Sinks the GREEN, Charge is LEAN,
Sinks the RED, Charge is DEAD.

Leading manufacturers of storage batteries use the Chaslyn Balls as Charge Indicators.

75c *At your dealer, or sent postpaid upon receipt of purchase price.*

The Chaslyn Company
3843 Ravenswood Ave., Chicago

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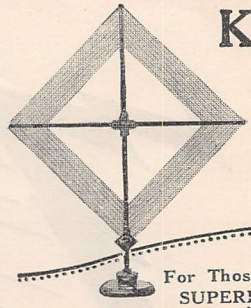


Tuned Loop
Multiple Switch Board Tuner
Directional Base Compass for Logging
Collapsible

For Those Who Demand SUPERIOR RESULTS

Leads the march towards perfect radio reception under all conditions. Not merely a "loop" but an ingenious arrangement of mechanical skill designed for superior results. L. M. Cockaday, using this loop, reached out across the Atlantic to audibly hear many trans-continental stations. **Selectivity Plus Distance** unheard of with common loop aerials. The Korach excels on all sets designed for loop reception. Priced at $16.50 and for sale by all good dealers. Full particulars sent for 2c stamp and name of local dealer.

KORACH RADIO CO.
20 E. Jackson Blvd., Dept. 7, Chicago, Ill.
Dealers and Jobbers: Write today for attractive proposition.

The Korach Junior
A modification of the "Senior" but possessing all its important features—$12.50.

When You're Talking WILLARDS To Your Customers

You can tell them that because of their power, steady current and freedom from electrical leakage, these very different radio batteries are used by over 200 leading broadcasting stations for standard amplifying equipment.

You can show them that the better job Willards do for the broadcasting station is the same identical job that the batteries in their own radio sets do.

You can give them visible proof that their Willards will be strictly brand new, and in the pink of condition when they get them—assurance that with an occasional recharge their Willards will operate like new batteries for years to come.

And when you've made the sale you know it's a clean one—the kind that makes satisfied customers— a sale that will require no service or further attention on your part.

Read about our plan for handling Willard Radio Batteries. It's the very plan you've wished some one would offer you.

WILLARD RADIO BATTERIES

Willard Storage Battery Co.

Cleveland, Ohio

The Right Selling Plan for Radio Dealers

Your local Willard Service Station will act as your jobber on Willard Radio Batteries.

This means a quick source of supply of strictly fresh, well charged batteries which you can turn over to your customers in the pink of condition.

No servicing problems for you. Your local Willard Service Station assumes the responsibility for service.

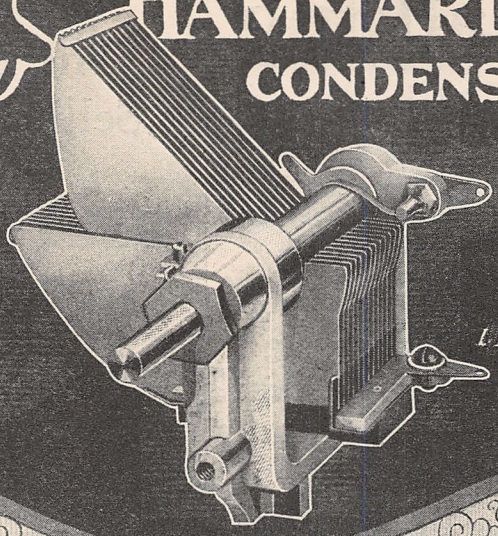
Willard Radio Batteries will be advertised more extensively than ever this fall. Have your local Willard Service Station show you this advertising and explain the details of this new and practical plan for selling radio storage batteries. The advertisements will be signed:

Sales and Service through
The **Willard Battery** men
and their
Authorized Radio Dealers

Appropriate signs and window cards will identify you as an Authorized Dealer. Booklets and other valuable selling helps will also be furnished.

Your Nearest Willard Service Station is Your Nearest Willard Jobber

The New HAMMARLUND CONDENSER



A STRAIGHT-LINE FREQUENCY ACHIEVEMENT

RUGGED, compact, sublimely efficient, with all the refinements of 15 years' experience comes the latest Hammarlund achievement —the condenser that distributes stations equally over your dials and solves the problem of critical tuning.

You will recognize many distinctive "HAMMARLUND" features of world renown. Others are new —the perfections of advanced engineering and the natural progress of the radio art.

Soldered, non-corrosive brass plates, with sturdy tie-bars that insure permanent alignment; one small piece of insulation placed outside of the electro-static field; strong, warpless aluminum frame, grounded to rotor; adjustable ball bearings at both ends of rotor shaft; bronze clock-spring pigtail; single hole mounting; new balancing device; a separate "hand-capacity" shield for use if desired; a quality product at a moderate price.

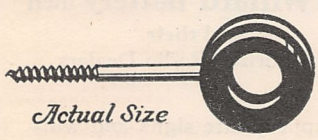
.0005 Mfd....$5.00	.0003 Mfd....$4.65
.000375 " ... 4.75	.00025 " ... 4.50

At the Better Dealers. Write for Descriptive Folder.

HAMMARLUND MANUFACTURING COMPANY
424-438 West 33rd Street New York City

For Better Radio
Hammarlund
PRECISION
PRODUCTS

Rubber Covered Insulators



Actual Size

Neat and efficient. For antenna, ground and for lead in wires. Small screw starts readily and makes finished job. Great improvement over ordinary large, unsightly insulators. They keep the wires in place and out of the way. Packed 10 in a box, 25c at your dealers or direct from us.

CULVER-STEARNS MFG. CO.
Worcester, Mass., U. S. A.

Free LOG also RADIO CATALOG

DEMAND
Our 1926 Beautiful Illustrated Catalog of all the latest Radio Merchandise.
JUST OFF THE PRESS!
The largest line of Standard Radio Merchandise in stock. Write for this Wonderful Book today, before you buy anything. Delay means losing exceptional chance to participate in this sale. All those who rush their name and address at once will receive also a
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288 Sixth Ave., Dept, A New York
DEAL DIRECT AND SAVE REAL MONEY
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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

good many of the points stressed above are rather small and superfluous and therefore not worthy of consideration. This, however will not be found to be true because in crystal detector work there is so little energy being handled by the set that every effort must be made to conserve it. Therefore, attention to detail is most necessary and if you fail to give it, your results will not come up to your expectations and you may be disappointed. Therefore, adhere to the principles laid down and you cannot go far wrong.

$300 PRIZE CONTEST

(*Continued from page* 593)

it necessary to go to press. We tried frantically to get in touch with the artist, but he had left no address, so it was a case of making a new cover or running the one with the 34 mistakes. We had no time to make a new one, so we printed the one which you now see adorning the magazine.

As we said before, the set is supposed to be the usual tuned radio frequency set. DON'T FORGET THAT! Of course, the usual set nowadays does not have the binding posts on the front panel. These are usually inside. But in order to show the connections to the reader, we took the liberty of putting the binding posts in front. That is what you might call "poetic license." *This in itself is no mistake,* as it was quite intentional.

Some of the mistakes have been so cleverly hidden that it will take you quite a while to puzzle them out. They are not all so easy, by any means. For instance, one of the mistakes is that there is no arrow-head above the left-hand rheostat. That counts as one error. There are 33 more besides this one for you to find. The thing is not as simple as it looks, and it takes a bit of ingenuity, logic, and thought to find all the mistakes. We have, therefore, inaugurated a $300 Prize Contest, with prizes as shown here, which will be paid for the best correct answers. We believe this is the most interesting and absorbing prize contest we have ever run. Start on it right now, and if you don't find all the mistakes at once, don't get discouraged. Maybe you'll find more of them tomorrow.

RULES OF THE CONTEST

1. Anyone may enter this Contest, with the exception of the employes of the Experimenter Publishing Company and their families.

2. Only one set of answers may be submitted by each contestant.

3. All answers must be typewritten or in ink. Penciled matter is not acceptable.

4. List as many mistakes as you can find, using a separate line for each mistake, numbering the first one "1," second one "2," etc., down to "34."

5. Make your answers as short as possible. THE SHORTEST CORRECT ANSWERS WILL BE AWARDED PRIZES IN THEIR CORRECT ORDER.

6. In case of a tie, identical prize-winning answers being submitted by different contestants, identical prizes will be paid to those tieing for the prizes.

7. This competition closes on November 15 at noon, by which time all answers must have been submitted.

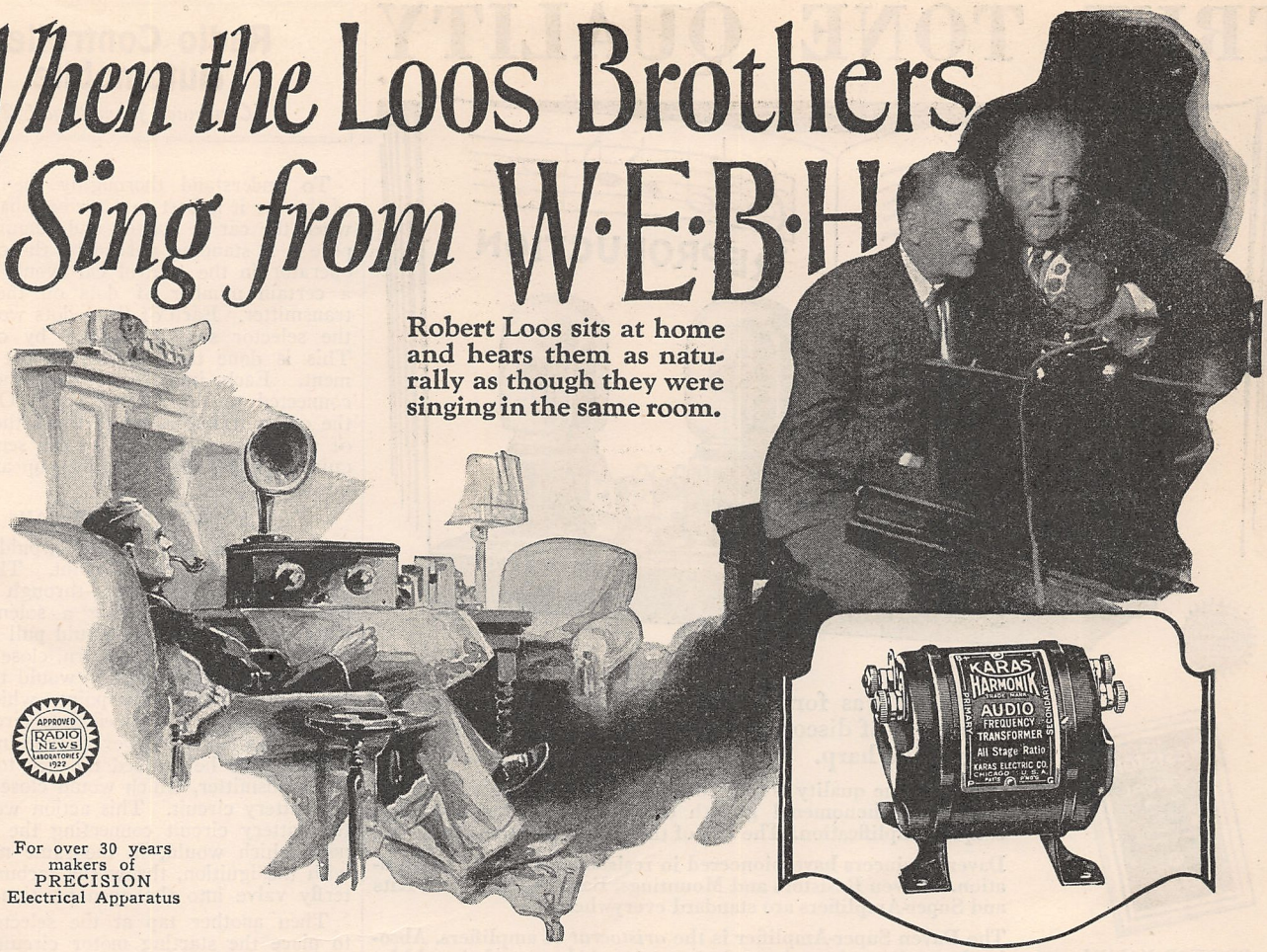
8. Address all entries to Editor "What's Wrong Picture," c/o Radio News, 53 Park Place, New York City.

HOPELESSLY ETHERIZED

No. 1: "Can't you reason with your husband?"

No. 2: "No. He's announcer at XPK, and always up in the air."

When the Loos Brothers Sing from W·E·B·H



Robert Loos sits at home and hears them as naturally as though they were singing in the same room.

APPROVED RADIO NEWS LABORATORIES 1925

For over 30 years makers of PRECISION Electrical Apparatus

Karas Harmonik Transformers

Amplify Radiocast Music with Absolute Fidelity!

No sooner had Karas Harmonik Transformers been introduced than letters began to pour in from all over the country.

Exacting set builders, after many disappointments, found in the Karas Harmonik an audio transformer which *really* amplified with tremendous volume — and positively without distortion.

"Now I know radio as I never knew it before." So Mr. E. M. Lubeck of Kokomo, Indiana, expressed himself. "Karas Harmoniks bring in every voice and every instrument as distinctly as one could get them in the room," wrote the Rev. Wm. Stellhorn of Columbus, Ohio. "I consider your transformer a real musical instrument. Like a good violin, it has fine tonal qualities at all pitches covering the musical scale," was the comment of Mr. Walter Krause of 7807 Burnham Ave., Chicago. Mr. G. C. Tubbs of Gratham, New York, told of his wonderful reception of a band concert from St. Louis, pointing out that every tone of every instrument could be picked out with perfect distinctness.

These few reports—picked at random from scores of letters—tell you more convincingly than WE can tell you, the wonderful results YOU can obtain through installing Karas Harmonik Transformers in your new set if you build one—or your old set if you keep it. Nothing like it has ever been known before the Karas Harmonik was produced. Nothing approaching it has ever been developed since. Remember, the finest loud speaker can't overcome the shortcomings of defective or inefficient transformers.

Here, for your enjoyment, is an audio transformer, scientifically designed to reproduce through your speaker *all* of the beauty of Radiocast music — exactly as it is rendered in the studio, whether by a soloist or the largest band or orchestra.

> Karas Electric Co., Chicago, Ill.
>
> Dear Sirs: I take great pleasure in praising your wonderful Karas Harmonic Transformers. I recommend them to the most critical. I am using two of them in a three-tube Low-Loss set which I built. I have two brothers singing from Edgewater Beach, WEBH Station, and whenever they are on we listen in. Well, their singing comes in so natural and clear that at times we think they are right in the same room with us. My brothers are known as Chicago favorites, the Loos Brothers, and they also tell me mine is the clearest set they have ever heard.
>
> Respectfully yours,
>
> Robert Loos, 1640 N. Leavitt St., Chicago, Illinois

The problem of amplifying high, low and medium audio frequencies to an equal degree has finally been solved. Sonorous bass notes pour forth from the speaker in full strength and rich tone quality. The vital harmonics and rich overtones are brought out in their true beauty by this marvel of audio transformers.

All last season, home set builders—the most discriminating class of radio enthusiasts — bought Karas Harmoniks and enjoyed a musical quality of radio reception that owners of factory-built sets knew nothing about. For set manufacturers mistakenly thought they could not pay a little more for Karas Harmoniks than common kinds cost.

If you want the utmost pleasure that radio has to offer, get a pair of Karas Harmonik Transformers at once. Whether you are building a new set, or intend to remodel an old one, it is very easy to put in Karas Harmoniks. Or, if you don't care to install them yourself, any radio repair man will do it for you at small expense. Why not make up your mind right now to have the best music your set is capable of giving?

Most good radio dealers carry Karas Harmoniks. If *your* dealer is out of them, order direct on the coupon below. Send no money, just pay the postman.

Karas Electric Co., 4036 N. Rockwell St., Chicago, Ill.

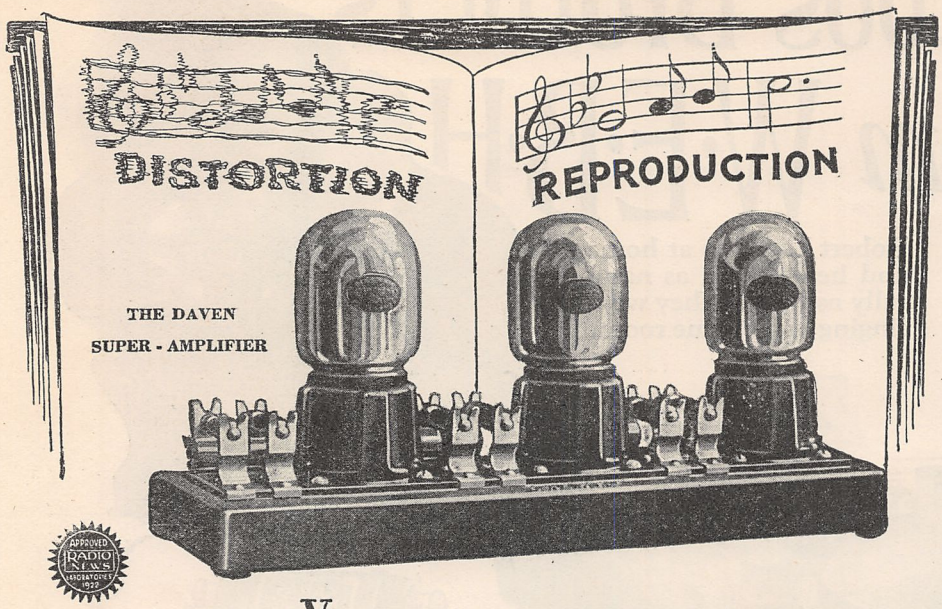
Please send me_____pairs of Karas Harmonik Audio Frequency Transformers. I will pay the postman $7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 30 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

*Name*_____

*Address*_____

If you send cash with order we'll send Transformers postpaid.

TRUE TONE QUALITY



RESISTOR MANUAL

The Handbook of Resistance Coupled Amplification. At Best Radio Dealers 25c. Direct by mail, postpaid 30c.

CLIP THIS COUPON

0-11-25

DAVEN RADIO CORPORATION
158-160 Summit St., Newark, N. J.
Please send me the following on Resistance Coupled Amplification:

Check one

☐ Resistor Manual. 30c is enclosed.
☐ Complete Catalog (free).

Name .....

Address .....

.....

FOR DEALERS: *Send your letterhead or card, or this coupon and we will have our nearest distributor communicate with you.*

VOLUME was formerly the goal of radio engineers. The blare of discordant trumpets succeeded the tinkling of the harp. The goal had been reached.

But true tone quality is the star we now are shooting at. This explains the phenomenal growth of the demand for resistance coupled amplification. The end of the era of distortion is in sight.

Daven engineers have pioneered in resistance coupled amplification. Daven Resistors and Mountings, Ballasts, Amplifier Kits and Super-Amplifiers are standard everywhere.

The Daven Super-Amplifier is the *aristocrat* of amplifiers. Absolutely no distortion. A revelation to music lovers. It is sold by dealers everywhere, complete, ready to connect with tuner and batteries, for $15.00.

DAVEN HIGH-MU TUBES

MORE volume of true tone quality is the latest achievement of Daven Engineers.

The new Daven Tube Type MU-20 increases the amplification of the Daven Super to equal or exceed that obtainable with transformers. 6 volt, ¼ ampere—$4.00 each.

The Daven Power Tube Type MU-6 for the last, or output stage —$5.00.

DAVEN PRODUCTS ARE SOLD ONLY BY GOOD DEALERS

"The Sine of Merit"

DAVEN RADIO CORPORATION

Resistor Specialists

Newark Reg. U. S. Pat. Off. New Jersey

THE BIG LITTLE THINGS OF RADIO

LEARN RADIO

Become a big-pay man in the greatest industry of all time. Quickly, easily and right at home, you can fit yourself for highest salary positions, or you can cash in on your spare time. The call is urgent for mechanics, operators, designers, inspectors. Unlimited, fascinating opportunities on land or sea.

I WILL TRAIN YOU AT HOME TO BE A RADIO EXPERT

Under my practical, easy to understand, instruction—you qualify in an amazingly short time. No previous experience is necessary. Every branch of radio becomes an open book to you. You learn how to design, construct, operate, repair, maintain and sell all forms of Radio apparatus. My methods are the latest and most modern in existence.

FREE Wonderful home construction tube receiving set of the latest design. **Write Today** "Radio Facts" **FREE**

A. G. Mohaupt, Radio Engineer, RADIO ASSOCIATION OF AMERICA, Dept. 1511, 4513 Ravenswood Ave., Chicago

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, New York City.

Radio Controlled Automobile

(*Continued from page* 592)

To understand thoroughly the operation of the car it is best to describe what happens when the car is started and running. Suppose it is standing parked by the curb. The operator in the control car would send out a certain number of dots on the selector transmitter. Each of these dots would move the selector switch forward by one point. This is done through the ratchet arrangement. Each impulse actuates the magnet connected to the ratchet arm. Of course, the operator knows at all times the location of the selector arm and so can send the required number of dots to pick up any circuit he desires.

STARTING THE CAR

For starting the car he would place it first upon the ignition point. This would directly close the circuit—through an intermediate relay—connecting a solenoid to a battery. This solenoid would pull its armature in, which would, in turn, close the ignition switch. The operator would then move the selector over one point, which would connect the gas adjustment into circuit ready for operation. However, nothing would happen until he pressed the key to the second transmitter, which would close the master battery circuit. This action would close the battery circuit connecting the gas solenoid which would, in the same manner as with the ignition, throw the carburetor butterfly valve into the open position.

Then another tap at the selector switch to place the starting motor circuit in position, followed by a second tap at the other key closing the circuit, would start the starting motor. It would continue to rotate as long as the second key was closed. Once the engine was started, the second key could be released.

The clutch is, of course, out and the service brake set. Another movement of the selector switch and a tap at the second key releases a brake, while the two keys worked again allows the motor on the clutch pedal to revolve slowly, thus gradually letting the clutch into place and starting the car. Then the operator must think fast. His next step is to set the selector for steer left and press the second key. Through this means he gets the car into the middle of the road. Then he quickly shifts the selector to the clutch and gives the second key another tap. This clears the clutch. All the time the car is going and its path must be watched and the control system held in readiness for an emergency. However, if everything is clear, once the clutch is out, a few more dots on the first receiver sets the selector switch to the gear shift connector and another dot on the control key connects a large solenoid in circuit which pulls the gear lever back into the "high" position. Then the clutch motor must be selected again and another dot sent so that the engine is connected to the back end. The tuning of the receiver on the radio car is, of course, as sharp as it is possible for them to be made. To the present no trouble whatsoever has been caused by interfering signals from other stations.

As the sets are now arranged, a fairly strong signal is needed to cause the relays to operate. From the experiences of the inventor up to the present time there will be little, if any, trouble caused by interference from outside stations actuating the mechanism. And since the power of the transmitters which control the car are of only 10 watts power, little interference to other stations will result from the use of the car.

Alden Sockets Take New Standard Tube Bases

TUBE manufacturers announced last summer that tubes were henceforth to have standard bases, making the terminals on all these standard tubes identical, in order that the purchaser of a set may use tubes adapted for use on storage batteries or tubes adapted for use on dry cells without any change in sockets.

This naturally raised the questions,—"Is there a new Na-Ald Socket to take these standard bases?" And, "Can present Na-Ald Sockets be made to take these standard bases?" The answer to both questions is: "Yes, there is a new Na-Ald Socket and several adapters for new tubes. See next page for illustrations.

FREE
"What to Build" information — mail coupon

An easy way to get clearer radio

MANY radio owners have put up with disturbing noises without realizing they could be lessened by keeping contacts clean.

Keep this in mind when you build a set and build this advantage into it with Na-Ald Sockets. Replace those in your present set if interested in getting clearer radio. Change to Na-Ald in the set you buy, if the manufacturer has not yet standardized on them.

A CINDER, so small that you can scarcely see it, is a trifle until it blows in your eye! Until then it *doesn't seem possible* that it could cause so much trouble. By the same token, it doesn't seem possible that a little corrosion on the contacts between tubes and sockets could cause so much trouble in a radio set.

Scarcely any one realizes the extraordinary importance of clean, bright, perfect contact, if you want to get clear radio free from exasperating noises. In all the field of electrical equipment, there isn't a single case (except perhaps the much offending doorbell push button) where ample provision is not made to keep contacts clean. How much *more* important it is for the radio set, the most delicate electrical apparatus in common use today.

Na-Ald de Luxe Socket

IN ORDER to insure clean contact at all times, use Na-Ald de Luxe sockets with their special clean-easy feature, which consists of a duo-scrape contact. By simply twisting the tubes back and forth in their sockets two or three times, corrosion is scraped off and the contacting surfaces come to rest *where the scraping has been done*, providing clean, bright, perfect contact in the easiest possible way. The tubes need not be removed. No other socket will do this. It provides the easiest possible way to get clearer radio.

These advantages are obtained with the new UX tubes; even with the new UX 199 and UX 120 when used in the Na-Ald 419X adapter.

de Luxe Cushion Socket

THE new Na-Ald de Luxe Cushion Socket provides, in addition to clean contact, other features improving your radio. The cushion is a shock absorber, eliminating such vibrations and disturbing noises as those produced by a trolley rumbling past your house, or by your loud speaker.

For the first time these cushion sockets permit the use of hidden wiring, together with direct, positive connections with the same metal that contacts with tube terminals, doing away with the binding posts. Such direct connections help toward clearer radio.

Lowest loss and highest insulating qualities are insured in Alden sockets by using Alden Processed, genuine bakelite. To get clearer radio, use Na-Ald sockets, not only in the set you build but also install them in the set you buy. See next page.

Send for free information on a selection of the best tested circuits.

ALDEN MANUFACTURING COMPANY
Makers of the famous Na-Ald Sockets and Dials
Dept. K-13, Springfield, Mass.

Alden Processed
NA-ALD
Sockets and Dials

ALDEN MANUFACTURING CO.,
Dept. K-13, Springfield, Mass.

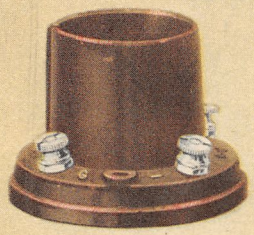
Please send "What to Build" information, together with information about the new standard-base tubes.

*Name*_____

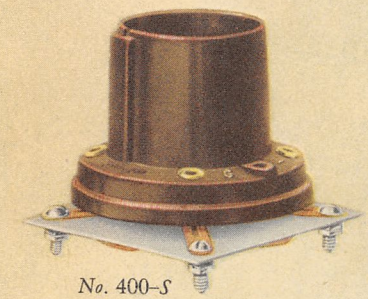
*Street*_____

*City*_____ *State*_____

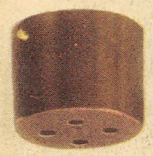
See handsome display of Na-Ald Products on next page



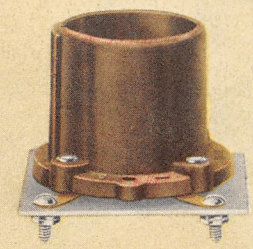
No. 400
75 *cents*



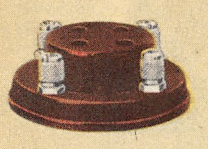
No. 400–*S*
75 *cents*



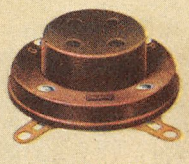
No. 419–X
35 *cents*



No. 401–*S*
50 *cents*

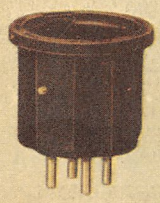


No. 481–X
35 *cents*



No. 481–X*S*
50 *cents*

No. 499–*S*
50 *cents*

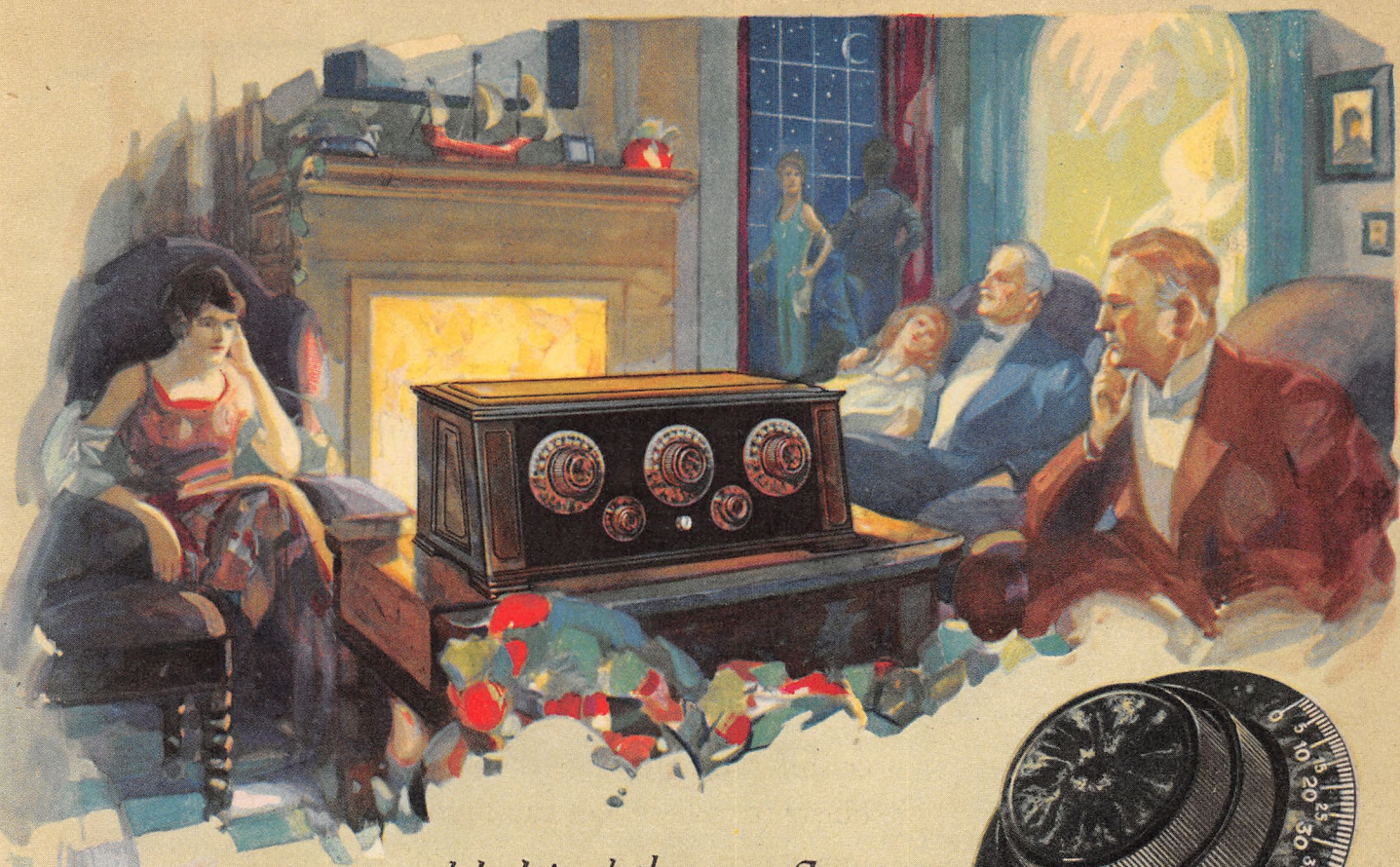


No. 429
75 *cents*

Now color adds its charm to the miracle of radio

LET the beautiful warmth and mellowness of blending hues and harmonies of color add to your enjoyment of the miracle of radio. How fitting that the turning of harmoniously colored dials should release the kindred harmonies of sound, which your radio brings you—the thunderous notes of the distant organ, the crashing ensemble of the symphony, mad bursts of passion; all the myriad voices of music that stir the emotions of the heart and uplift it with happiness.

Let color make your set more than an instrument of mechanics and currents. Let it blend in beauty with the most exquisite furnishings of your home. Express your individuality in radio's latest creation —Na-Ald Colored Dials.

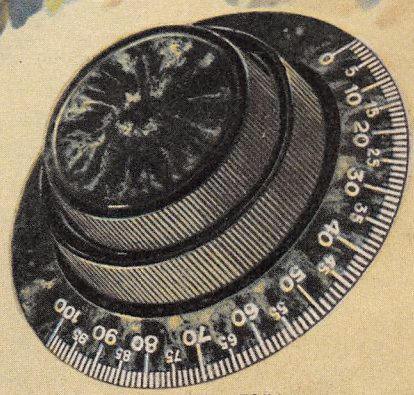


~and behind the mystery lies technical perfection~

And behind the Na-Ald colored dials, in the hidden mysteries of the set, have the proper Na-Ald Sockets, so that the delicate unseen currents may do their full work without loss. And when corrosion, at the contact points of tubes and sockets, chokes the voice of your radio, let your hand pass from tube to tube without removing them. Give each a few turns back and forth and clean away this corrosion, which is the enemy of pure reception. Na-Ald sockets, and *only* Na-Ald sockets, with patented duo-pressure scraping contacts accomplish this important work in this simple way. Send today for Na-Ald literature that your radio may have added beauty and perfection.

ALDEN MANUFACTURING COMPANY
Makers of the famous Na-Ald Sockets and Dials
Springfield, Mass.

Alden Processed
NA-ALD
Sockets and Dials



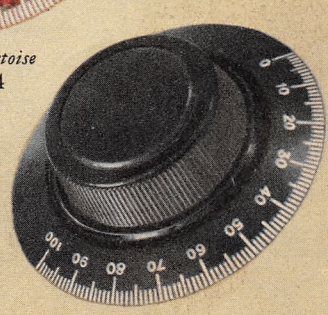
Malachite-green No. 3054
$2.50

Garnet No. K3674

Brilliant Tortoise No. 3044

No. K3844

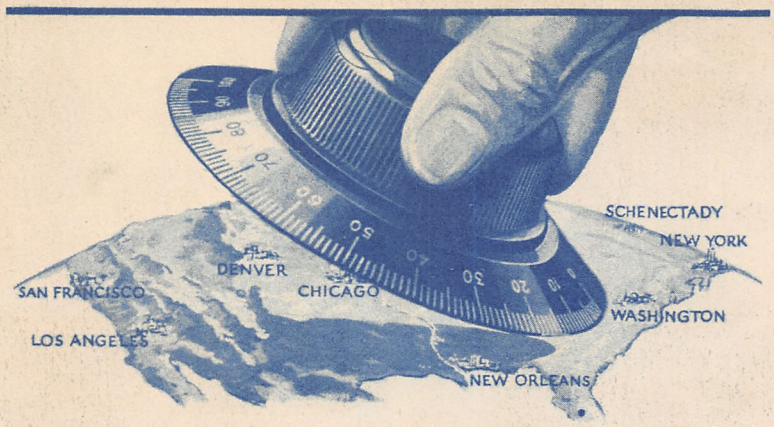
Mahogany No. 3034



Black No. 3044

$5 The SET

Na-Ald de Luxe Dial Set in all colors.



Can you tune in quickly?

What a difference a good dial makes

NOTHING has been found as easy as the dial for quick, accurate tuning because the eyes are directed to one spot where the numbers appear, thus eliminating the inconvenient and eye-tiring effort of following a pointer around a fixed scale.

The graduations are clear cut and scientifically determined as to length and locations. Good appearance and easy tuning are combined in Na-Ald Super-de Luxe dials.

You can obtain Na-Ald Dials at radio, electrical, and hardware stores everywhere. Be sure you have Na-Ald bakelite dials in the set you build or buy.

Send for free "What to Build" information, showing a number of the best tested and selected circuits.

New colored dials give surprisingly handsome appearance

LIKE making a new set out of an old one is the striking and pleasing change brought about by equipping your radio with the new Na-Ald beautifully colored dials, the newest thing out. This improvement is just what is needed to give thousands of sets an appearance in keeping with the decorative beauty of the homes in which they are placed. Imagine how it will improve your set to install garnet, malachite-green (like mottled green and white marble), brilliant tortoise, or grained mahogany dials. Obtainable in regular dials, the new vernier, and the new man-size five-inch dial.

ALDEN MANUFACTURING COMPANY
Manufacturers of Na-Ald Sockets and Dials
Dept. K-13, Springfield, Mass.

ALDEN MANUFACTURING CO.,
Dept. K-13, Springfield, Mass.

Please send "What to Build" information, together with information about the new standard-base tubes.

*Name*_____

*Street*_____

*City*_____ *State*_____

Alden Processed
NA-ALD
Sockets and Dials

New!

Vernier Dial

AFTER months of engineering and practical experiments, we can now offer you this new Vernier Dial. Every desirable feature is included, combining all the best qualities which a Vernier should have. The mechanism is enclosed in the dial itself and is simple, positive and sturdy. So smooth and positive in operation that to try it is to want it. Even turning the dial farther than it should go cannot injure it.

This Vernier is an Alden Processed Bakelite Dial, with a minimum amount of metal. There is no "live" metal, so the dial does not carry the hand capacity to the panel. It matches the standard Na-Ald Dial so that you can use this Vernier on the critical condenser, and plain dials on the others.

This new Vernier fits all the various condenser constructions. It is attached quickly and satisfactorily and is one of the few Vernier dials that can be used on a condenser with one-hole mounting and on metal panels. No possibility of backlash under any conditions.

New Man-Size Five Inch Dial

ANOTHER new Na-Ald Dial is massively built—five inches in diameter. It has a double knob and provides a comfortable man-size grip. Your fingers do not cover up the numbers. There are 200 graduations instead of the usual 100, and the arrangement of the numerals results in quick, easy reading.

With this big knob and the 200 graduations it is possible to swing from station to station—quickly and accurately. It is generally preferred to the Vernier on sets that do not have critical tuning, such as the neutrodyne.

Both the new Na-Ald Vernier Dial and the new Na-Ald five-inch dial are furnished in the handsome new colors.

Prices

Super-de Luxe 3" Dial No. 3034—black 50c; any color $1.00.

Super-de Luxe 4" Dial No. 3044—black 75c; any color $1.50.

Boxed and matched set of three 4" Dials (No. 3044), and two rheostat knobs (K 3844), any color $5.00.

5" Dial No. 3054 and Vernier dial No. 6044—in black each $1.50; brilliant tortoise $3.00; other colors $2.50. Colors: black, grain mahogany, malachite-green, brilliant tortoise, and garnet.

See handsome display of Na-Ald Products on preceding page

MacMillan received and sent with Thordarson Transformers

If you were commissioned to explore the polar regions, you too would be very particular to select the best equipment — especially in radio, your sole means of communication.

ZENITH
KENNEDY
WL
RADIODYNE
GL
Pfanstiehl
Howard
Thermiodyne
GLOBE
Deresnadyne
ADLER-ROYAL
MURDOCK
MU-RAD
Valley
Silver-Marshall
OZARKA
ULTRADYNE
Newport
LEICH
NUNN-LANDON
KUSTOMBILT *and many others use*

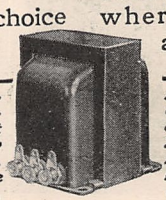
THORDARSON Super Amplifying Transformers — the identical transformers sold by dealers everywhere and used in a majority of quality sets—have been the exclusive choice of MacMillan on his Arctic expeditions.

Surely no greater tribute can be paid to the actual supremacy of Thordarson Transformers, product of the world's oldest and largest exclusive transformer specialists. Faultlessly they amplified programs and messages from great distances on the 1923-1924 expedition — and came back "as good as new." Equally successful was their performance on the last expedition.

The wisdom of MacMillan's choice is further confirmed by the fact that year after year, leading builders of fine sets — makers of fine instruments especially noted for distance and superb tone qualities—use more Thordarsons than all competitive transformers combined.

In addition to Thordarson audio frequency and power amplifying transformers in his receiving sets, Mac Millan chose Thordarson Transformers for exclusive use in his broadcasting station, WAP, on board the Peary. WAP successfully broadcast the weird voices and instruments of Eskimo entertainers back to civilization.

Thordarsons cost more to build — but no more to buy. Dealers everywhere. Interesting bulletins on amplification mailed free.



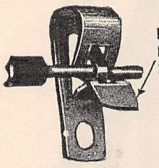
The Thordarson "Autoformer" All Frequency Amplifiers are our latest development. They amplify clearly the lowest as well as the highest notes of any instrument. An adaption of impedances, resistances and capacities. Write for the Autoformer Hook-up Bulletin—it's free.

Autoformers are $5 each. Other Thordarson Radio Transformers: Audio Frequency (subpanel or top mounting types), 2-1, $5; 3½-1, $4; 6-1, $4.50. Power Amplifying, $13 the pair. Interstage Power Amplifying, each $8. If dealer cannot supply, order from us.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.

THORDARSON
Super
AMPLIFYING TRANSFORMERS
Standard on the majority of quality sets

FAHNESTOCK CLIPS



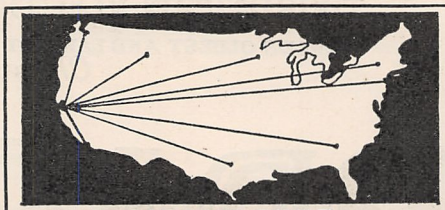
"Popular Wherever Radio Is Used."

FAHNESTOCK Connectors are used by nearly every manufacturer of standard radio sets. On all batteries made by the National Carbon Co. FAHNESTOCK makes connectors for every radio purpose.

"THE IDEAL CONNECTOR"

Catalog sent upon request

FAHNESTOCK ELECTRIC COMPANY
Long Island City, New York



ON ONE TUBE

BIG FREE BOOKLET tells the story. California users of CROSS COUNTRY CIRCUIT hear Atlantic Coast, Canada, Mexico, Cuba and Hawaii. Our new plan makes this set easiest and cheapest to build. One hour puts in operation. One tuning control. No soldering. Any Novice can do it. BOOKLET FREE or complete instructions 25c.

Vesco Radio Co., BOX DRN-117 OAKLAND, CALIF.

9-825

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

Radio Set Directory

Continued from page 631

Trade Name: Arionola M6
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Without
Loud Speaker: Separate
Controls: Three
List Price: $79.75

Manufacturer: THE W. B. Duck Co.
711 Adams St., Toledo, Ohio
Trade Name: Duck Type A-884 De Luxe Balanced
Circuit: Tuned radio frequency
Batteries: Both
Antenna: None
Loud Speaker: Separate
Control: Three
List Price: $100

* * *

Trade Name: Duck Type A-884 De Luxe Balanced
Circuit: Tuned radio frequency
Batteries: Both
Antenna: None
Loud Speaker: None
Controls: Three
List Price: $125

Manufacturer: ELECTRICAL PRODUCTS MFG. CO.,
69 Sprague St., Providence, R. I.
Trade Name: Dymac Selecto-5
Circuit: Dymac Balanced radio frequency
Batteries: Either
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three vernier, quick acting
List Price: $75

Manufacturer: COLONIAL RADIO CORP.
East Ave. and 10th St., Long Island City, N.Y.
Trade Name: Colonial Model 16-5
Circuit: Tuned compensated radio frequency
Batteries: Dry
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $125

* * *

Trade Name: Colonial Model 16-6
Circuit: Tuned compensated radio frequency
Batteries: Dry
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $175

* * *

Trade Name: Colonial Model 17
Circuit: Tuned combination radio frequency
Batteries: Dry
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $58.00

* * *

Trade Name: Colonial Model 20-6
Circuit: Tuned combination radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $175

* * *

Trade Name: Colonial 21-5
Circuit: Weagant
Batteries: Storage
Antenna: Outside
Loud Speaker: Separate
Controls: Three
List Price: $87.50

* * *

Trade Name: Colonial Model 23-5 phonograph panel
Circuit: Weagant
Batteries: Storage
Antenna: Outside
Loud Speaker: Separate
Controls: Three
List Price: $85

* * *

Trade Name: Colonial Model 24-5 portable
Circuit: Tuned combination radio frequency
Batteries: Dry
Antenna: Both
Loud Speaker: Separate
Controls: Two
List Price: $85

Manufacturer: ELECTRICAL RESEARCH LABORATORIES.
2500 Cottage Grove Ave.
Chicago, Ill.
Trade Name: Erla Circloid Five De Luxe cabinet
Circuit: Tuned radio frequency, licensed under U. S. Navy patent
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $77.50

* * *

Trade Name: Erla Circloid Five De Luxe cabinet
Circuit: Tuned radio frequency, licensed under U. S. Navy patent
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $69.50

* * *

Trade Name: Erla Circloid Five De Luxe cabinet
Circuit: Tuned radio frequency, licensed under U. S. Navy patent
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in
Controls: Three
List Price: $142.50

* * *

Trade Name: Erla Circloid Five De Luxe cabinet
Circuit: Tuned radio frequency licensed under U. S. Navy patent
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in
Controls: Three
List Price: $113.50

Manufacturer: ELGIN RADIO SUPPLY CO.,
270 E. Chicago St., Elgin, Ill.
Trade Name: Elgin Super-Reinartz
Circuit: Differential regenerative
Batteries: Either
Antenna: Both
Loud Speaker: Built-in
Controls: One
List Price $75

* * *

Trade Name: Elgin-Super-Reinartz
Circuit: Differential regenerative
Batteries: Either
Antenna: Both

$25

West of Rockies, $26.50
In Canada, $35

The SAAL Soft SPEAKER

brings the best out of your set

YOU may have the best receiver ever built, but the quality of your entertainment is limited by the quality of your speaker. Bring the best out of your set by using the Saal Soft Speaker.

The Saal does not force you to choose between volume and tone quality. It combines volume with a velvet tone. It is not a fad. It is not a trumpet. It is a faithful reproducer of radio programs, properly constructed and shaped for the accurate reproduction of sound. It removes the objection to loud speakers. It has no blare, no blast, no metallic ring.

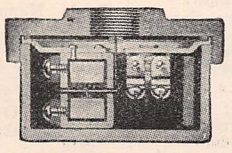
The Saal Soft Speaker is made to last a lifetime. The neck is of aluminum. The bell is of genuine Bakelite. There is no wood, no tin, no composition. It has nothing to warp, crack or deteriorate. The reproducing unit is of all-metal construction and cannot be harmed or "blasted" by the loudest receiver. It maintains its tone with any volume. There is no adjustment knob to complicate tuning.

In appearance the Saal with its black bell, black crackle throat and graceful lines is the aristocrat of horns. Also furnished with a brown bell and gold or silver stippled throat at $5 extra. It is guaranteed to give you satisfaction. Hear it at your dealer's today.

SAAL Jr.

The same in every respect as the Saal Soft Speaker except it measures 18½ instead of 21½ inches in height.

$20 *West of Rockies, $21*
In Canada, $27.50



In the Saal Soft Speaker Unit the action of four pole pieces of a powerful magnet are concentrated on a carefully poised armature. This armature is connected to the diaphragm by a pin. This pin moves the diaphragm with a push and pull motion. There are no springs. The action is extremely precise, reproducing all consonants and overtones, yet the unit can't get out of order. This unit is used as standard by many leading manufacturers of fine radio receivers in built-in models.

SAAL *Soft* SPEAKER

VOLUME WITH TONE QUALITY

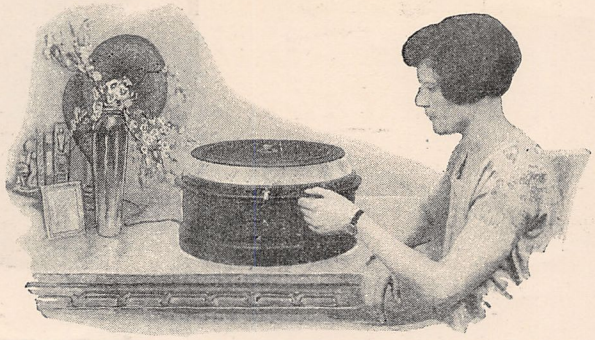
Manufactured and guaranteed by H. G. SAAL COMPANY, 1800 Montrose Ave., Chicago, Ill.

NO-DIAL 5 Tube Receiver $98.00 less accessories

~and Now a Receiver Without Dials! Simple, trouble-proof, beautiful- New!

Licensed under Blackmore Patents and Patents Pending. Hogan Patent 1,014,002.

NO-DIAL is a new combination of tuned radio frequency and resistance coupling.



The Set for Every Member of the Family

Listen! Sweetly clear, an overture, the prelude to a concert in a distant city floats into the room and fills it. A touch of the finger brings it to you. No need to know about radio—no need to understand its myriad technical terms.

A wonderful instrument is the NO-DIAL, so simplified that it is amazing! There are no dials to twist—none of the trying nervous tension that the adjustment of dials produces—just pure enjoyment. Be you ever so much of a novice, what you must do for yourself with other radio sets—The NO-DIAL does for you.

Scrap the log book—forget past radio disappointments. NO-DIAL is the griefless, worryless receiver you have been waiting for. The entire edge of the cover is a permanent, visible station record. Stations once found and recorded always come in at that same point. It's that simple!

The cylindrical NO-DIAL case is of spun aluminum, absolutely shielding it from body capacity. Finished in beautiful brown mahogany crystalline matching the higher priced loud speakers.
Tube for tube the NO-DIAL recognizes no superior and on test it has outperformed many higher priced sets.

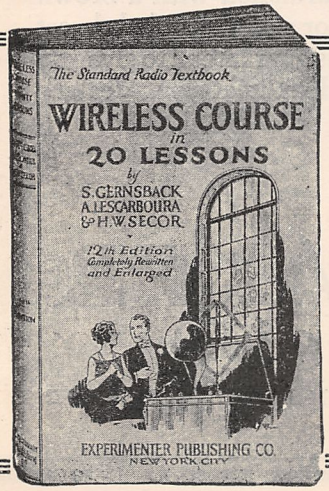
GUARANTEED

The NO-DIAL is guaranteed against defects in workmanship and material.

Place your order now with your dealer if you expect to get delivery. The demand is exceeding all expectations. Accept no complicated substitutes.

Literature Sent on Request

THE OHIO STAMPING AND ENGINEERING COMPANY, Dayton, Ohio, U. S. A.



The Standard Radio Text Book

12th EDITION

264 Pages of Radio—500 Illustrations.
Size 6 x 9 Inches—DeLuxe Binding.
Genuine Gold Stamped—Round Corners.

PRICE $2.00

Experimenter Publishing Co., Inc.
53 Park Place :: :: New York, N. Y

Loud Speaker: Separate
Controls: One
List Price: $55

Manufacturer: THE EQUITABLE RADIO CORPORATION
300 Madison Ave., New York City
Trade Name: Claratone Model No. 124
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Either
Loud Speaker: Separate
Controls: Three
Liet Price: $39

* * *

Trade Name: Claratone Model No. 124 L. S.
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Either
Loud Speaker: Built-in
Controls: Three
List Price: $60

* * *

Trade Name: Professional Model No. 124-P
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $45

Manufacturer: CHARLES FRESHMAN, INC.
240-248 W. 40th St., New York City and 327 So. LaSalle St. Chicago, Ill.
Trade Name: Freshman Masterpiece Model 5-F-2
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Separate
Controls: Three
List Price: $39.50

* * *

Trade Name: Freshman Masterpiece Model 5-F-5
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price: $60

* * *

Trade Name: Freshman Masterpiece Model 5-F-4
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Separate
Controls: Three
List Price: $49.50

* * *

Trade Name: Freshman Masterpiece Concert Model
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price: $75

* * *

Trade Name: Freshman Masterpiece set of Franklin Console
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price $75

* * *

Trade Name: Freshman Masterpiece Model 5-F-7
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price: $89.50

* * *

Trade Name: Freshman Masterpiece Model 5-F-6 with table
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price: $82.50

* * *

Trade Name: Freshman Masterpiece Franklin Console
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor or indoor (no loop)
Loud Speaker: Built-in
Controls: Three
List Price: $115

Manufacturer: GAROD CORP.
124 Adams St., Newark, N. J.
Trade Name: Garod Neutrodyne Type V
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $195

* * *

Trade Name: Garod "Georgian"
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $400

Manufacturer: GOLDEN LEUTZ, INC.
476 Broadway New York City
Trade Name: Super-Pliodyne 9
Circuit: Tuned radio frequency Farrand patent
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $295

* * *

Trade Name: Plio 6
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $60

* * *

Trade Name: Universal Plio 6, 35 to 3600 meters
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $125

Manufacturer: A. H. GREBE & CO., INC., 113 West 57th St., New York, N. Y.
Trade Name: Synchrophase Type MU-1
Circuit: Tuned balanced radio frequency
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $155 less accessories

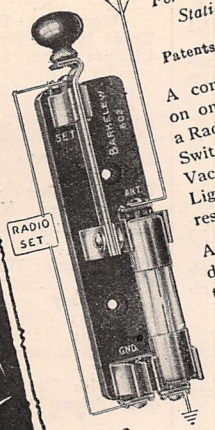
* * *

Trade Name: Synchrophase Type MU-2
Circuit: Tuned bal-

BARKELEW
RADIO ACCESSORIES

LIGHTNING ARRESTER SWITCH
For Receiving Stations

Patents Pending



A combination on one base of a Radio Ground Switch and a Vacuum Tube Lightning Arrester.

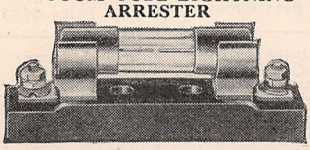
A distinctive device for those who know and demand the best lightning protection.

Price $2.50

No. 602

Approved by the Underwriters Laboratories.

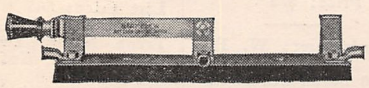
VACUUM TUBE LIGHTNING ARRESTER



No. 606 **Price $1.50**

Required on the antenna of every Receiving Station. Approved by the Underwriters Laboratories.

GROUND SWITCH



No. 600 **Price $2.50**

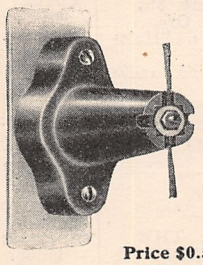
Required on all Transmitting Stations—Built of 60 Ampere Copper.

"LEAD-IN" INSULATOR
For Receiving Stations

No. 612 **Price $0.60**

Spaces the "Lead-In" Wire 5 inches out from the wall.

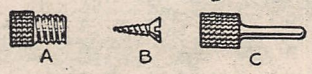
PORCELAIN PEDESTAL
Brown Glaze



No. 611 **Price $0.50**

An insulator with a rigid clamp for the lead-in wire. A pedestal for spacing Ground Switches or other apparatus, 5 inches clear of the mounting surface.

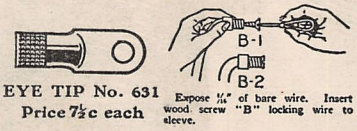
Screw Grip
DONT SOLDER
Cord Tips!



PATENTS PENDING

PIN TIP No. 630
Price 5c each

The Universal Sleeve "A" has an internal thread. Screw it on end of wire.



EYE TIP No. 631
Price 7½c each

Expose ¼" of bare wire. Insert wood screw "B" locking wire to sleeve.

FORK TIP No. 632
Price 7½c each

Screw on any of our standard Screw Grip Tips shown at left.

A cord tip that requires no solder, no wrapping of the insulation and no tools other than a pen knife and a small screw driver.

CONFIDENCE

THE annual increase in the number of dealers selling Barkelew Accessories expresses the confidence of the Radio Public in our product.

Special attention is called to the No. 605 Antenna Selector Switch and the Screw Grip Cord Tips. Both items were introduced late last year but will have their best run during the present season.

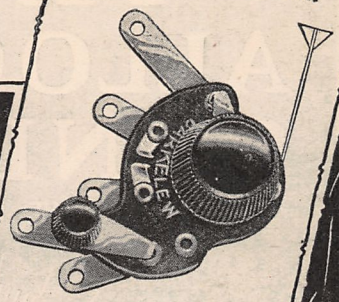
All radio material is packed in paper cartons and well labeled, making excellent shelf stock.

The design is good, materials are carefully selected and workmanship by skilled mechanics.

Prices and discounts are right for a fast moving line. This means a profitable stock.

For full description of each item, see our new Radio Catalog at your dealer. If he hasn't his copy, we have one for him.

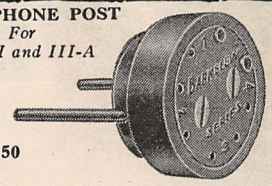
ANTENNA SELECTOR SWITCH
For Radiola III and III-A



No. 605 **Price $1.00**

The entire range of antenna adjustments may be obtained by simply turning the two knobs, without loosening a nut. The antenna wire attaches to the one binding post on the rear.

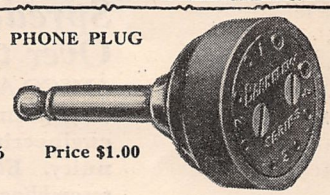
FOUR PHONE POST
For Radiola III and III-A



No. 624
Price $0.50

The prongs on this post fit through phone holes in the face of panel. It takes one to four head-sets in series.

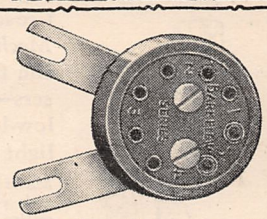
FOUR PHONE PLUG



No. 616 **Price $1.00**

Connects one to four head-sets in Series to any Radio set using telephone jacks.

FOUR PHONE POST



No. 628

Price $0.50

For binding post mounting. Connects one to four head-sets in series to the more common types of brass phone posts.

CORD TIPS
With Solder Inserted

No. 623 **Price $0.05 ea.**

The wire hole is tinned and half full of solder. Heat and insert the wire.

PLAIN CORD TIPS

No. 627 **Price $0.01 ea.**

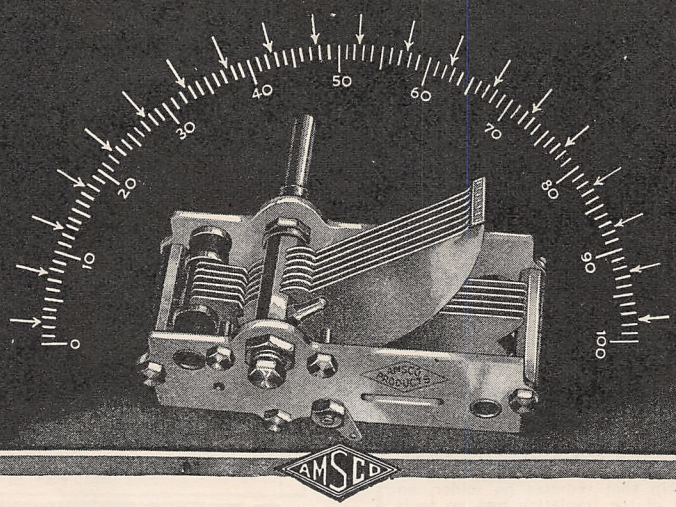
A nickel plated tip for those who can do their own soldering.

The Barkelew Electric Mfg. Co.
Middletown, Ohio, U. S. A.

NEW YORK, 157 Chambers St.
BOSTON, 31 Bedford St.
WASHINGTON, D. C., Mills Bldg.
CHICAGO, 15 S. Clinton St.
DENVER, Denham Bldg.
MINNEAPOLIS, 1017 Lumber Ex.
SEATTLE, 1041 Sixth Ave. S.
SAN FRANCISCO, 75 Fremont St.
LOS ANGELES, 443 S. San Pedro St.
TORONTO, No. 7 Crang Ave.
MONTREAL, 296 St. Paul St. W.

The AMSCO ALLOCATING CONDENSER

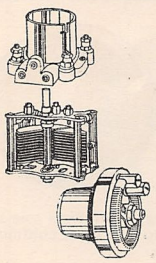
(STRAIGHT LINE FREQUENCY)

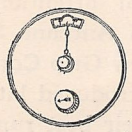


Spreads the Stations Over the Dial—The new AMSCO Allocating Condenser is the triumphant combination of electrical engineering and mechanical ingenuity. *Electrically efficient* in *unscrambling* the stations on your dials. Each dial degree from 1 to 100 will be found to represent 10 broadcasting kilocycles accurately over the entire scale—*"a station for every degree"*. *Mechanically ingenious* in correcting the fault of other S. L. F. Condensers—*it conserves space!* Scientific low-loss construction. Rigidity with light weight.

Made in three capacities—Single or Siamese. Ask your dealer, or write for details of the entire AMSCO Line of engineered radio parts.

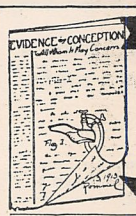
AMSCO PRODUCTS, INC. *Dept. F*
Broome and Lafayette Streets, N.Y.C.





New!—a handsome instrument at a low price. The AMSCO Vernier Dial gives finesse to your fingers. Steps-down 13 to 1, backwards or forwards, fast or slow without momentum or back-lash.

STORAD
RADIO "A" AND "B" BATTERIES
give the kind of service that your multi-tube set requires. Write for information or ask your dealer.
The Cleveland Engineering Laboratories Co.,
2142 Superior Viaduct, N.W., Cleveland, Ohio



PATENTS
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Before disclosing your invention to anyone send for free blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed.
LANCASTER & ALLWINE
Reg. Pat. Attys. in U. S. and Canada
270 Ouray Bldg., Washington, D. C.
Originators of the form "Evidence of Conception"

The EAGLE Neutrodyne RECEIVER
is "King of The Air"
Write for literature.

WE SOAR ABOVE
EAGLE RADIO COMPANY
NEWARK NEW JERSEY

You must see our new 64-page Catalog before you buy anything in Radio. It's FREE. WRITE TODAY!
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 2 CHICAGO, ILL.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year
Experimenter Publishing Co., 53 Park Place, N. Y. C.

anced radio frequency
Batteries: Dry cell
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $320 less accessories

* * *

Trade Name: Synchrophase Type MU-1 Console
Circuit: Tuned balanced radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in
Controls: Three
List Price: $320

* * *

Trade Name: Synchrophase Type MU-2 Console
Circuit: Tuned balanced radio frequency
Batteries: Dry cell
Antenna: Both
Loud Speaker: Built-in
Controls: Three
List Price: $320 less accessories

Manufacturer: GUNDLACH MANHATTAN OPTICAL CO., Rochester, N. Y.
Trade Name: Korona Radio Crystal Receiver
Type of Set: Crystal

Manufacturer: THE HALLDORSON CO., 1772 Wilson Ave., Chicago, Ill.
Trade Name: Halldorson Receiver R. F. 500
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $75

Manufacturer: W. B. HALLER, 2100 Sarah St., S. S. Pittsburgh, Pa.
Trade Name: Hallerio 3
Circuit: Crystal
Antenna: Outdoor
Controls: Two
List Price: $3

* * *

Trade Name: Hallerio 4
Circuit: Crystal
Antenna: Outdoor
Controls: Two
List Price: $4

* * *

Trade Name: Hallerio 5
Circuit: Crystal
Antenna: Outdoor
Controls: Two
List Price: Complete aerial equipment and phones $6

Manufacturer: HALLOCK & WATSON RADIO CORP., 190-192 Park St., Portland, Ore.
Trade Name: "Halowat TR-5
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $90

Manufacturer: THE JEWETT RADIO & PHONOGRGAPH CO. Pontiac, Mich.
Trade Name: Jewett Receiver
Circuit: Fieldless capacity tuned
Batteries: Either
Antenna: Indoor or outdoor
Loud Speaker: Separate
Controls: Two
List Price: $140

Manufacturer: HONESDALE RADIO CO., c/o The Krantz & Sell Co., Honesdale, Pa.
Trade Name: Wayne 4
Circuit: One stage radio frequency detector, two audio frequency
Antenna: Outdoor
Batteries: Storage
Loud Speaker: Separate
Controls: One
List Price: No. 1, $50; No. 2, $55

* * *

Trade Name: Wayne 5
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $65

* * *

Trade Name: Wayne Superior
Circuit: Reflex
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Controls: Two
List Price $100

Manufacturer: INDIANA MFG. & ELECTRIC CO., Marion, Ind.
Trade Name: Indiana Hyperdyne No. 500
Circuit: Tuned radio frequency
Batteries: Both—storage recomended
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $65

* * *

Trade Name: Indiana Hyperdyne No. 700 Console
Circuit: Tuned radio frequency
Batteries: Both—storage recommended
Antenna: Outdoor or indoor
Loud Speaker: Built-in
Controls: Two
List Price $175

Manufacturer: JOSEPH W. JONES RADIO MFG. CO. 40-46 W. 45th St., New York City
Trade Name: J-65
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $65. less equipment

* * *

Trade Name: J-80
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Made to fit upright phonograph
Controls: Two
List Price: $80.00

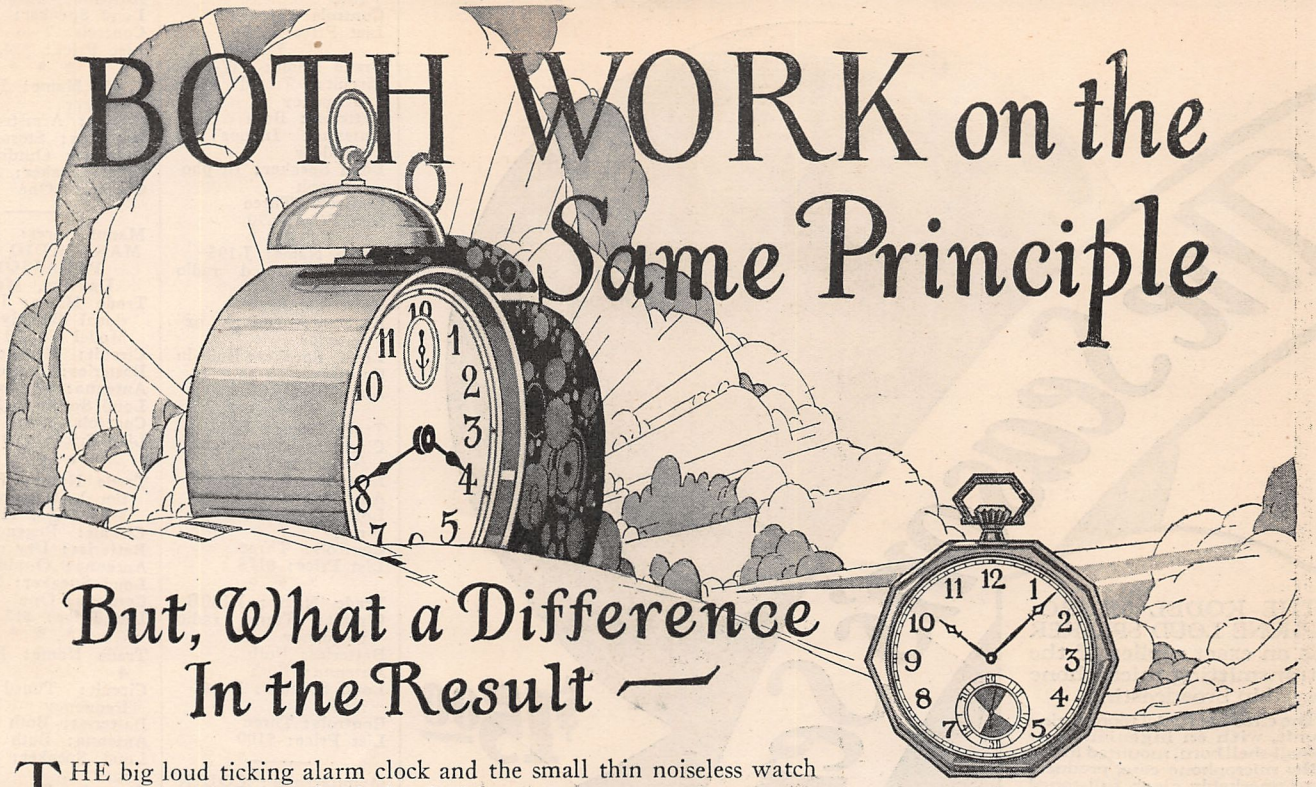
* * *

Trade Name: J-75
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $75

* * *

Trade Name: J-85
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Both

BOTH WORK on the Same Principle



But, What a Difference In the Result —

THE big loud ticking alarm clock and the small thin noiseless watch are much alike in mechanical principle.

The difference lies in quality of material and workmanship and a scientific refinement in application. Volume in a loud speaker is no longer a distinguishing factor.

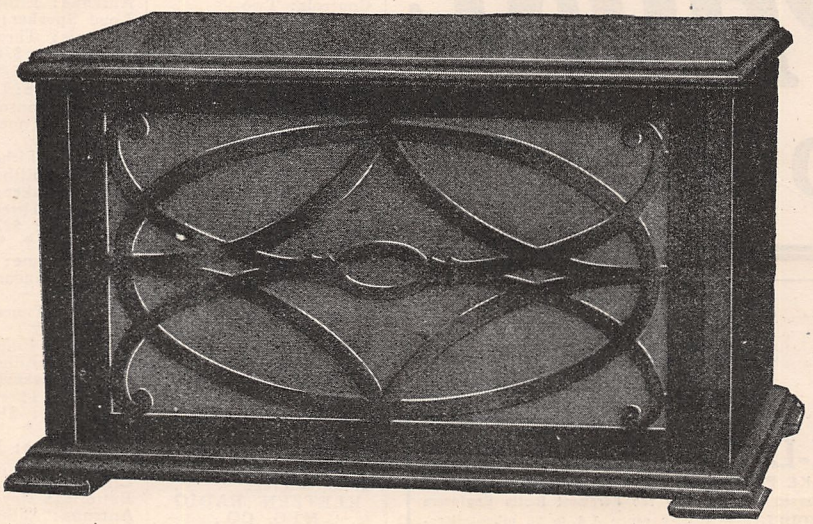
The fine point is tone—a clear, natural reproduction of voice or instrumental music attained by the application of the most scientific principles.

The Bristol Loud Speaker with its highly developed electromagnetic tone mechanism, non-metallic horns, and long, freely vibrating sound chambers, gives pure harmony of reception.

Models S and C are equipped with a specially designed diaphragm of broad pitch range. It reproduces not only the low pitched notes but the high as well.

There are four models, priced at $15.00 to $30.00. If not at your dealers, send for Bulletin 3025-S.

A Happy Christmas Suggestion



CABINET MODEL "C" $30.00

Size 17 x 10 x 10¼". Beautifully finished mahogany. Full floating wooden horn and cast metal throat.

THE BRISTOL COMPANY
Waterbury, Conn.

Bristol AUDIOPHONE Loud Speaker

TRADE MARK REG U.S. PAT OFF

FOR 36 YEARS Ask Any Technical Engineer MAKERS OF BRISTOL'S RECORDING INSTRUMENTS

THE KODEL MICROPHONE LOUD SPEAKER is an exact replica of the transmitting microphone used in broadcasting.

The effecient Kodel reproducing unit, with an ingenious new snail-shell horn, mounted inside the microphone case, produces a remarkably clear, full-toned volume. Non-vibrating tone chamber eliminates distortion.

The $15 model incorporates the new Kodel, Jr. unit; with the large Kodel unit, $20.

Radio dealers everywhere have them

THE KODEL RADIO CORP.
501 E. Pearl St., Cincinnati, O.

Design Patented

The KODEL MICROPHONE LOUD SPEAKER

A-1 CRYSTALS GET DISTANCE
FOR KENTUCKY USER

"A-1 Crystal is sure wonderful. Can hear local reception on Horn in next room. It is a common occurrence to get KDKA, PITTSBURG (500 miles); WGY, WLS, WTB, WTAM, WOS and others." L. B. D., Covington, Ky.

A-1 THE WONDER CRYSTAL

for Reflex or Crystal Set.
Sent postpaid, 50c each. 60c C. O. D.

CALIFORNIA RADIO MINERALS
Harry Grant, Jr.
904 Oak Grove Avenue, Burlingame, Cal.

ALMOST TOO GOOD TO BE TRUE

X-L VARIO DENSERS

MAKE POOR SETS GOOD—GOOD SETS BETTER
Endorsed and Used by the Foremost Radio Engineers

MODEL N—Capacity range 1.8 to 20 micro-micro-farads, for balance in Roberts two tube, Browning-Drake, McMurdo Silver's Knockout, Neutrodyne and tuned radio frequency circuits. **Price $1.00**

MODEL G—Two capacity ranges, .00016 to .00055 and .0003 to .001 Microfarads, for the Cockaday circuit, filter and intermediate frequency tuning in superheterodyne and positive grid bias in all sets. **Price $1.50**

X-L RADIO LABORATORIES
2426 Lincoln Ave. CHICAGO

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year
Experimenter Publishing Co., 53 Park Place, N. Y. C.

Loud Speaker: Separate
Controls: Three
List Price: $85

* * *

Trade Name: JW-90
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Indoor or Outdoor
Loud Speaker: In phonograph
Controls: Three
List Price: $90

* * *

Trade Name: J-195
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Indoor or outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $195

* * *

Trade Name: J-175
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $175

* * *

Trade Name: J-100B
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Both
Loud Speaker: Separate
Controls: Three
List Price: $100

Manufacturer: COLIN B. KENNEDY CORP., 2017 Locust St., St. Louis, Mo.
Trade Name: Kennedy Royal Sixteen
Circuit: Balanced tuned radio frequency
Batteries: Optional
Antenna: Loop or outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $235

* * *

Trade Name: Kennedy Model 15
Circuit: Balanced tuned radio frequency
Batteries: Optional
Antenna: Both
Loud Speaker: Separate
Controls: Two
List Price: $120

* * *

Trade Name: Kennedy Model 20
Circuit: Balanced tuned radio frequency
Batteries: Optional
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $90

* * *

Trade Name: Kennedy Model 6
Circuit: Regenerative detector and three stages of audio amplification
Batteries: Optional
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $25

Manufacturer: KLETZEN RADIO MFG. CO., 31 Ottawa Ave., Grand Rapids, Mich.
Trade Name: Kletzen-Kent
Circuit: Armstrong
Batteries: Either
Antenna: Outdoor
Loud Speaker: None
Controls: Two
List Price: $42.50

* * *

Trade Name: Kletzen-Wolverine
Circuit: Armstrong
Batteries: Either
Antenna: Outdoor
Loud Speaker: None
Controls: Two
List Price: $54.50

* * *

Trade Name: Kletzen-Badger
Circuit: Armstrong
Batteries: Storage
Antenna: Outdoor
Loud Speaker: None
Controls: One

Manufacturer: KENMAR RADIO CORPORATION, Danvers, Mass.
Trade Name: International Babydyne Model No. 10
Circuit: Regenerative
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: None
Controls: One
List Price: $10

* * *

Trade Name: International Babydyne Model No. 11
Circuit: Regenerative
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: None
Controls: One
List Price: $13.50

* * *

Trade Name: Kenmar 4
Circuit: Tuned radio frequency
Batteries: Both
Antenna: Both
Loud Speaker: Separate
Controls: Two
List Price: $85.

Manufacturer: KODEL RADIO CORPORATION 507-521 E. Pearl St., Cincinnati, Ohio
Trade Name: Logodyne Big 5 Cabinet
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Outdoor preferably
Loud Speaker: None
Controls: Three
List Price: $90

* * *

Trade Name: Logodyne Standard 5 Cabinet
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Either
Loud Speaker: None
Controls: Three
List Price: $70

* * *

Trade Name: Logodyne Big 5 Console
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Either
Loud Speaker: Built-in
Controls: Three
List Price: $275

* * *

Trade Name: Logodyne Standard 5 Console
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Either
Loud Speaker: Built-in
Controls: Three
List Price: $165

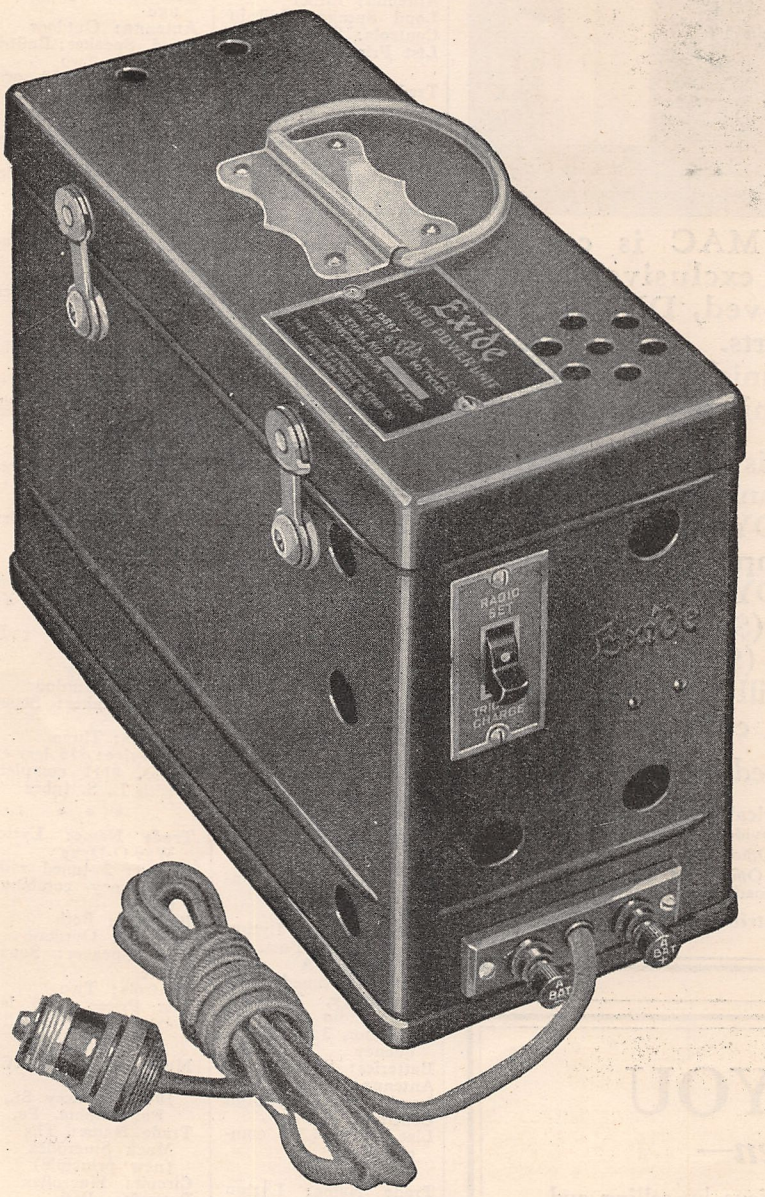
* * *

Trade Name: Kodel Gold Star
Circuit: Kodel
Batteries: Dry cell
Antenna: Either
Loud Speaker: Separate
Controls: Two
List Price $30

* * *

Trade Name: Kodel Gold Star Cabinet
Circuit: Kodel
Batteries: Dry cell
Antenna: Both
Loud Speaker: Separate
Controls: One
List Price: $20

Announcing the *New* radio battery that is always charged



HERE is something that will be welcomed by all radio fans—a compact "A" storage battery and charger, known as the Exide Radio Power Unit.

This unit is assembled in an attractive metal case, and is kept at all times connected to the ordinary house current as well as to the radio set.

Upon raising a small switch on the end of the unit, the receiving set is ready for use; by throwing it down, the battery is automatically placed on charge. Thus battery-charging, in its most convenient form, practically becomes a part of set operation.

The battery, of course, is an Exide, specially designed for the unit, and has ample capacity for any receiving set—whether that set uses one tube or ten. As there are no moving parts to wear or get out of order, maintenance cost is low.

Finished in a rich mahogany color, the Exide Radio Power Unit is furnished in two sizes—one, for sets using 4-volt tubes; the other, for sets using 6-volt tubes; retailing at $28 and $38 respectively—slightly higher west of the Rockies.

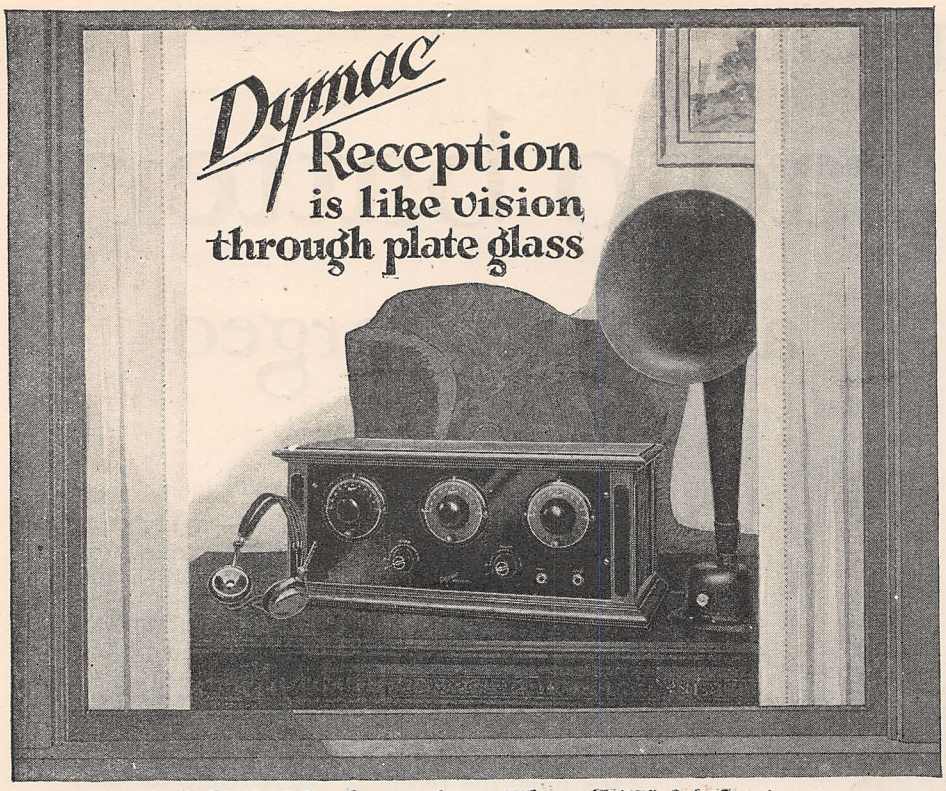
There are, in addition, Exide "A" and "B" storage batteries for every requirement, and a rectifier for recharging "B" storage batteries. Inquire of any Exide Dealer or at your favorite radio store.

The Electric Storage Battery Company
Philadelphia

Exide Batteries of Canada, Limited, 153 Dufferin Street, Toronto

Exide
RADIO POWER UNIT

FOR BETTER RADIO RECEPTION, USE STORAGE BATTERIES



AS LOOKING through plate glass gives a clear eye-picture, so reception from a DYMAC Selecto Five gives a true, clear ear-picture of transmitted sound.

The DYMAC represents something different in set construction — it's not just a receiver but a fine musical instrument built to render complete and accurate reproduction of tonal values.

The DYMAC is constructed exclusively of time-proved, DYMAC-made parts. Cabinet is walnut finish mahogany with ebonized panels.

Its price is $75. If your dealer can't supply you with a DYMAC Selecto Five promptly, write direct to us. DYMAC Type G Headset ($5) and Loud Speaker ($8.50), shown above, will increase your reception enjoyment.

Every DYMAC Product guaranteed one year

Type E Headset, $3.
Vernier Dial, $1.50
Loud Speaker Unit, $5.
Soldering Set (Standard) $2.50
Crystal Set (Complete) $7.50
Sub-panel Socket, 75c.

IT'S A Dymac PRODUCT

Electrical Products Mfg. Co.
Providence, Rhode Island
N. Y. Office: Metropolitan Tower
Export Office: Ad. Auriema, Inc., 116 Broad Street, New York City

DYMAC Factory Sales Agents in Principal Distribution Centres

PRIZES FOR YOU

Boys and Young Men—

You can earn dandy prizes and liberal commissions by selling and delivering our popular magazines in your spare time. No experience or money is necessary. We furnish all supplies and tell you just how to start. *Write to-day.*

E. J. FOLEY, DEPARTMENT RN-11

Experimenter Publishing Company
53 Park Place, New York City

Trade Name: Kodel
Circuit: Kodel
Batteries: Dry cell
Antenna: Either
Loud Speaker: Separate
Controls: One
List Price: $12

* * *

Trade Name: Kodel Gold Star Crystal
Antenna: Outdoor
List Price: $60

* * *

Trade Name: Logodyne Unitrola Universal Phonograph receiving set
Circuit: Tuned radio frequency
Batteries: Either
Antenna: Either
Loud Speaker: Separate
Controls: Three
List Price: $87.50

* * *

Trade Name: Kodel Four-Tube Portable
Circuit: Kodel
Batteries: Dry cell
Antenna: Either
Loud Speaker: Built-in
Controls: Two
List Price: $75

* * *

Trade Name: Kodel Two-Tube Portable
Circuit: Kodel
Batteries: Dry cell
Antenna: Both
Loud Speaker: Separate
Controls: One
List Price: $25

* * *

Trade Name: Kodel One-Tube Portable
Circuit: Kodel
Batteries: Dry cell
Antenna: Both
Loud Speaker: Separate
Controls: One
List Price: $18

* * *

Trade Name: Logodyne Panel Assembled Kits
Circuits: Tuned radio frequency
Batteries: Either
Antenna: Either
Loud Speaker: None
Controls: Three
List Price: $65, $50

Manufacturer: LYTTON INC., 1120 Lytton Bldg., Chicago, Ill.
Trade Name: Lytton Portable Model 103
Circuit: 1 tuned radio frequency, 2 aperiodic detector, 2 audio frequency
Batteries: Storage
Antenna: Loop
Loud Speaker: Built-in
Controls: Two
List Price: $195 complete

* * *

Trade Name: Lytton "Compass" Port. Model 103-A
Circuit: 1 tuned radio frequency, 2 aperiodic radio frequency detector, 3 audio frequency
Batteries: Storage
Antenna: Loop
Loud Speaker: Built-in
Controls: Two
List Price: $225 complete

* * *

Trade Name: Lytton Wav-O-Dyne No. 201
Circuit: 2 tuned radio frequency complete
Batteries: Dry or small storage
Antenna: Outdoor
Loud Speaker: Built-in upright table cabinet
Controls: Two
List Price: $195, or $220 complete

* * *

Trade Name: Lytton Super-Wav-O-Dyne Model 105
Circuit: 3 tuned radio frequency combination
Batteries: Dry or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $195 less extras, and $255 installed

* * *

Trade Name: Lytton Standard Console Model 100
Circuit: 2 tuned radio frequency
Batteries: Dry or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $195 or $220 installed

* * *

Trade Name: Lytton Concert Console Model 401-A
Circuit: 2 tuned radio frequency combination
Batteries: Dry or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $350, or $372 complete

* * *

Trade Name: Lytton Duplex No. 99-T
Circuit: Duplex reflex crystal detector
Batteries: Dry
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $19.75 less equipment

* * *

Trade Name: Portable Cabinet Model
Circuit: Duplex reflex crystal detector
Batteries: Dry
Antenna: Wire, straight antenna
Loud Speaker: Separate
Controls: One
List Price: $25 less equipment

* * *

Trade Name: Lytton Standard Model No. 100
Circuit: Tuned radio frequency
Batteries: Dry
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $75 less extras, $111 complete, with L. S. tubes

* * *

Trade Name: Lytton Wav-O-Dyne
Circuit: 2 tuned radio frequency combination
Batteries: Both
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $165 less extras, $221 installed

Manufacturer: MACK CO., 1940 Delancey St., Philadelphia, Pa.
Trade Name: The Mack Sincroflex (new principle)
Circuit: Sincroflex
Batteries: Both
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $50

Manufacturer: MARTIN RADIO & ELECTRIC CO. 130 West 52nd St., New York City
Trade Name: Packard 5
Circuit: Tuned radio frequency
Batteries: Storage

Radio drafted Bakelite

so all could listen-in

"Polyplug"
Polymet Mfg. Co.

Dial
The Bell Mfg. Co.

Rheostat
Yaxley Mfg. Co.

Aristocrat Dial
Kurz-Kasch Company

Condenser
Sangamo Electric Co.

Condenser
Bremer-Tully Co.

To make available for everyone, everywhere, the marvel of radio reception, radio engineers required an insulating material possessing a unique combination of properties.

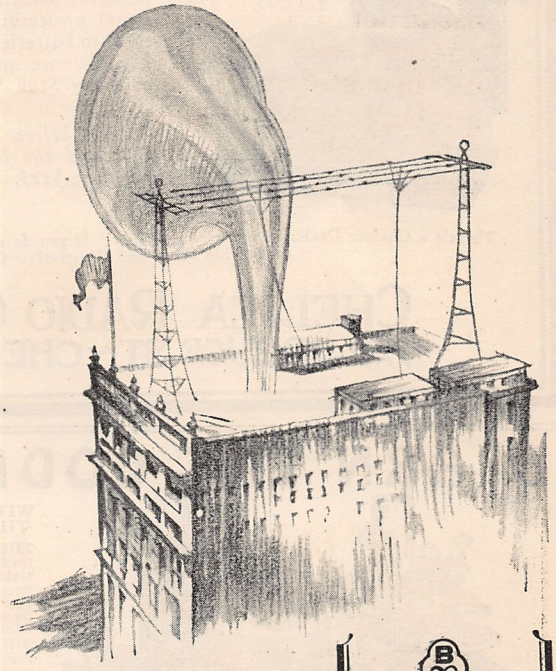
Bakelite alone met the need. It combines high insulation value with strength and light weight. It is easily formed into the many shapes required and will not warp, shrink nor swell. It will not absorb moisture and is unaffected by extremes of heat and cold.

All of these properties and the beautiful color and finish of Bakelite are permanent—unaffected by time, use or climate. So "Radio drafted Bakelite," and today it is used by over 95 per cent of radio set and parts manufacturers.

Make sure that the radio set or parts that you buy are Bakelite insulated, for good insulation is essential to clear reception.

Write for Booklet 24

BAKELITE CORPORATION
247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22nd Street



Bakelite is an exclusive trade mark and can be used only on products made from materials manufactured by the Bakelite Corporation. It is the only material which may bear this famous mark of excellence.

BAKELITE

REG. U.S. PAT. OFF.

BAKELITE
is the registered trade mark for the phenol resin product manufactured under patents owned by the Bakelite Corporation.

THE MATERIAL OF A THOUSAND USES

Again CHELSEA TRIUMPHS

New CHELSEA Super Five $50.00

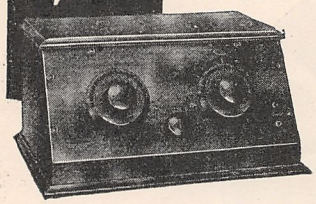
With Added Features

These new models defy comparison, possessing all the refinements and efficiency of the highest priced sets. The ultimate in selectivity and volume, yet a child can get results.

The Super-Five with its beautiful mahogany cabinet, rugged bus wiring, hand-soldered connections, no unsightly binding posts, and other advanced features, meets the popular demand for a moderately priced Receiver of highest quality.

$26.00 Three Tube Receiver

Licensed Under Armstrong Patent No. 1113149.



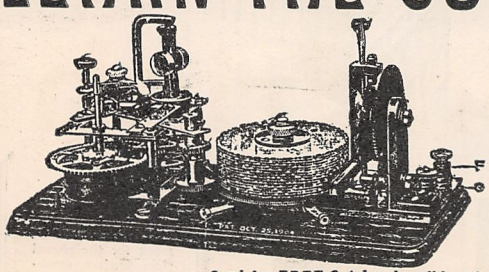
The only genuine Armstrong circuit 3-Tube Receiver with a dust-proof, fool-proof inside panel protecting the "vitals." Cord connections to batteries and many other refinements. For distance and real tone quality, the equal of many $100 Sets. See it at your Dealer's.

Other Chelsea Models include the Super-Six, $60, and the Super-Five with fine Built-in Speaker, $125.

There's a Chelsea Dealer in nearly every City. If you do not know your Chelsea Dealer, write us for his name and illustrative Circular A.

CHELSEA RADIO COMPANY
179 SPRUCE ST ~ CHELSEA, MASS.

LEARN THE CODE AT HOME



WITH THE **OMNIGRAPH**

THE **OMNIGRAPH** Automatic Transmitter will teach you both the Wireless and Morse Codes—**right in your own home**—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or to Sounder, it will send you unlimited messages, at any speed, from 5 to 50 words a minute.

THE **OMNIGRAPH** is not an experiment. For more than 15 years, it has been sold all over the world with a money back guarantee. The **OMNIGRAPH** is used by several Depts. of the U.S. Govt.—in fact, the Dept. of Commerce uses the **OMNIGRAPH** to test all applicants applying for a Radio license. The **OMNIGRAPH** has been successfully adopted by the leading Universities, Colleges and Radio Schools.

Send for FREE Catalog describing three models. DO IT TODAY.

THE OMNIGRAPH MFG. CO., 15 HUDSON STREET, NEW YORK CITY

If you own a Radio Phone set and don't know the code—you are missing most of the fun

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year
Experimenter Publishing Co., 53 Park Place, N. Y. C.

Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $45

Manufacturer: MAZDA RADIO MFG. CO.,
3405 Perkin Ave., Cleveland, Ohio
Trade Name: Consonello Grand
Circuit: Radio frequency
Batteries: Storage
Antenna: Loop
Loud Speaker: Built-in
Controls: Two
List Price: $250

* * *

Trade Name: Consonello
Circuit: Radio frequency
Batteries: Storage
Antenna: Loop
Loud Speaker: Separate
Controls: Two
List Price: $150

* * *

Trade Name: Consonello Junior
Circuit: Reflex
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $40

* * *

Trade Name: Consonello Portable
Circuit: Radio frequency
Batteries: Dry cell
Antenna: Loop
Loud Speaker: Built-in
Controls: Two
List Price: $225

Manufacturer: METROPOLITAN ELECTRIC CO.,
811 24th St., Des Moines, Iowa
Trade Name: A Meco Model 2
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $60

* * *

Trade Name: Meco Model 10
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price $100

* * *

Trade Name: Meco Model 6 Semi-Console
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $125

* * *

Trade Name: Meco Model 5 Console
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $200

Manufacturer: MINERVA RADIO CO.,
827 Irving Park Blvd., Chicago, Ill.
Trade Name: Minerva Elite
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $125

* * *

Trade Name: Minerva Distantia De Luxe
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $60

* * *

Trade Name: Minerva Console Grand
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $255

* * *

Trade Name: Minerva Console Serenade
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Contro's: Three
List Price: $200

Manufacturer: MIDWEST RADIO CO.,
410 East Eighth St., Cincinnati, Ohio
Trade Name: Miraco Ultra Five
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $59.50

Manufacturer: WM. J. MURDOCK CO.,
347 Washington Ave., Chelsea, So. Mass.
Trade Name: Murdock Neutrodyne No. 100
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $100

* * *

Trade Name: Murdock Neutrodyne No. 101
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $92.50

Manufacturer: MOHAWK ELECTRIC CORPORATION
2220 Diversey Blvd., Chicago, Ill.
Trade Name: Mohawk Model 100
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $100

* * *

Trade Name: Mohawk Consolette Model X
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $175

* * *

Trade Name: Mohawk Console Model XII
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $225.

* * *

Trade Name: Mohawk Phonograph Panel
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $85

Manufacturer: MURAD RADIO CORPORATION
Asbury Park, N. J.

No Cracking
No Chipping

DRILL and machine the Goodrich Silvertown Radio Panel with full confidence—no special tools are required—it won't break at the edge, crack or chip.

It is made with a full degree of Goodrich skill and rubber knowledge, after long study of radio requirements—the product of a company that has always held quality and service as first considerations.

Science says that rubber is the best material for panels. Then by all means buy the *best* rubber panel—and that brings you straight to Goodrich Silvertown.

Fifty-five years of rubber manufacturing experience are a guarantee of greatest efficiency in the following products Goodrich has built for radio—

Goodrich V. T. Sockets *Spaghetti Tubing*
Goodrich Variometers Unwound *Battery Mats*
Goodrich Radiophone Ear Cushions

The B. F. Goodrich Rubber Company
Established 1870 Akron, Ohio

1 Easier to drill and machine.

2 Better color, lasting luster.

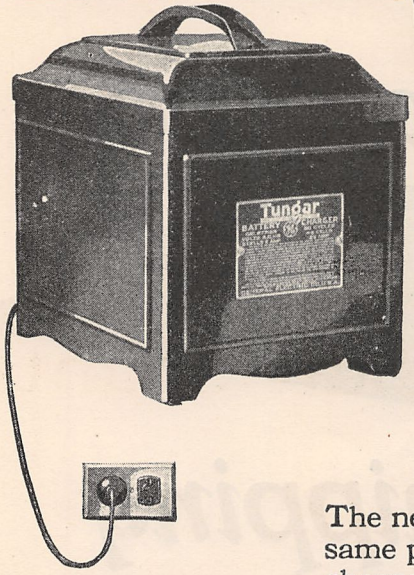
3 Lower free sulphur—no discoloration.

4 Higher softening point—no warping.

Goodrich Silvertown

The Radio Panel Supreme!

MEETING POPULAR DEMAND



5 ampere Tungar in a new model!

The new five ampere Tungar—at the same price as the old—means a quick charge of all kinds of storage batteries.

—It is more silent than ever.
—It cannot burn out Radiotrons.
—It cannot create radio interference.
—It is ideal for auto batteries—and charges 2 to 6 volt radio "A" batteries, or 24 to 96 volt "B" batteries, in series—all without attachments.

The Tungar is a G-E product developed in the great Research Laboratories of General Electric.

Two ampere Tungar (East of the Rockies). $18.00

Five ampere Tungar (East of the Rockies). $28.00

60 cycles—110 volts

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER

TUNGAR—a registered tradem ark—is found only on the genuine. Look for it on the name plate.

Merchandise Division
General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

BLUEBIRD RADIO TUBES

—are powerful—sensitive for distance, give clear volume and long service.

GUARANTEED

to work in Radio Frequency, Neutrodyne, Super Heterodyne and Reflex.

WITH BAKELITE BASE

Type 401A
Type 400
Type 499
Type 412
$2.00 All Standard Types

Also 499A with Standard Base 202-5 Watt Transmitter $3.00

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Ouray Building Washington, D. C.

Cable address: RADIOPAT
Telephone: Main 4806

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Trade Name: Model A
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $175

* * *

Trade Name: Model B
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price: $125

Manufacturer: NORTHWESTERN RADIO MFG. CO., 1556 East Taylor St., Portland, Oregon
Trade Name: Norco (standard cabinet)
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $65

* * *

Trade Name: Norco Type D
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $100

* * *

Trade Name: Norco De Luxe
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $150

Manufacturer: OPERADIO CORPORATION
8 S. Dearborn St., Chicago, Ill.
Trade Name: Operadio Portable
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Loop or outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $186 complete with tube and batteries.

Manufacturer: NU-TONE RADIO CO., INC., 505 Atlas Bldg., Salt Lake City, Utah
Trade Name: Nu-Tone N. R. 5-A
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $110

* * *

Trade Name: Nu-Tone N. R. De Luxe 25
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $310

* * *

Trade Name: Nu-Tone N. R. 7-A
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $180

* * *

Trade Name: Nu-Tone N. R. 8-A
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $175

* * *

Trade Name: Nu-Tone N. R. 6-A
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $145

Manufacturer: PERRY RADIO SUPPLY CO.
218 Washington Blvd., River Forest, Ill.
Trade Name: Perasco Kewpie
Circuit: Simple single
Batteries: Storage or dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: One and switch lever
List Price: $25

* * *

Trade Name: Perasco PA-III Audio Frequency Amplifier
Circuit: Two stage audio frequency amplifier
Batteries: Storage or dry cell
Antenna: None
Loud Speaker: Separate
Controls: None
List Price: $35

* * *

Trade Name: Perasco Petit Grand
Circuit: Grimes reflex
Batteries: Dry cell or storage
Antenna: Loop or antenna
Loud Speaker: Separate
Controls: Two
List Price: $175

* * *

Trade Name: Perasco Type PRD-II Radio Receiver
Circuit: Harkness reflex
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $50

* * *

Trade Name: Perasco Two-Stage Type PA-IV Amplifier
Circuit: Two stage audio frequency amplifier
Batteries: Dry cell or storage
Antenna: None
Loud Speaker: Separate
Controls: None
List Price: $40

Manufacturer: PFANSTIEHL RADIO CO., 11 So. La Salle St., Chicago, Ill.
Trade Name: Model 7 Overtone Receiver (Pfanstiehl)
Circuit: Pfanstiehl non-oscillating system tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $140

* * *

Trade Name: Pfanstiehl Model 8
Circuit: Pfantiehl non-oscillating system of tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $85

after all.....

"HOW WELL YOU CAN HEAR" is the only thing that really counts

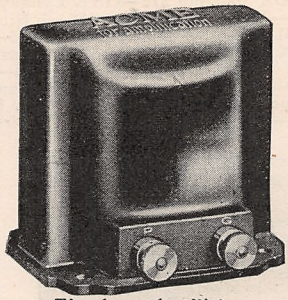
Look to your amplifying transformer if your set fails to pass this "quality test"

AS ONE radio fan to another, let's admit a few things.

After all, when a fellow settled back in his easy chair and wants some real entertainment, isn't "How well you can hear" the only real satisfaction in owning a radio set?

Up here at Cambridge we've been making radio transmitting and receiving apparatus since the days when radio was "wireless."

We've found that the only thing worth experimenting with is quality—this amplification without distortion. If you would like to test your own or any other set for quality, here's the way to do it.

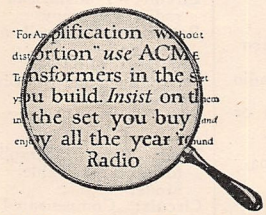


The Acme Amplifying Transformer
Amplifies properly not only the middle range of music and voice, but the sensitive over and undertones usually blurred out. New closed model, type MA-2, price $5.

Tune in and at the same time start talking with a friend.

Unless you can understand the voice over the radio with as much ease as that of your friend . . . and without any more effort or concentration . . . then you are not getting quality . . . you have distortion.

For distortion is something more than mere howls and squeals . . . it is anything which prevents you from getting exact, faithful reproduction of the human voice.



JUST as a magnifying glass enlarges but does not distort print, so Acme MA-2 transformers enlarge but do not distort sound.

If you find that it requires more attention and effort to hear the radio voice than that of your friend, this is the reason.

The individuality of the radio voice has been blurred out by distortion. The peculiar characteristics that make your voice recognizable from mine, the sensitive overtones and undertones, have been drowned. The result is a monotone, a droning flatness always difficult to understand.

Yet almost any set can be made to give quality reproduction, if certain precautions are taken.

First of all, look to your amplifying transformers. Here is usually where the trouble lies. Most transformers fail to have the high, flat prolonged amplification curve essential to correctly amplify the sensitive, delicate over and undertones. Hence distortion.

Replace your transformers with Acme Ma-2's which give amplification without distortion and repeat the voice test.

If distortion lies elsewhere, our nearest service station will be glad to aid you in locating and remedying its cause.

Send for this helpful book

THE whole story of distortion and how it can be overcome is carefully and fully explained in a 28-page book, "Amplification without Distortion," the 9th edition of which is just off the presses. Over 200,000 of our friends have already found previous editions helpful. Perhaps this new edition will help you get quality, too. At any rate send for it and see.

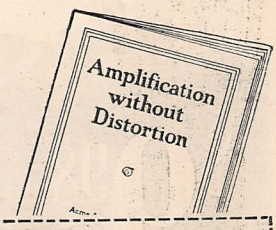
Claude Cairns

CLAUDE F. CAIRNS, *President, Acme Apparatus Co.*

9th edition of this famous book just off the press

Send for your copy!

THE complete story of distortion and how to prevent it is clearly and fully described in this famous book, of which over 200,000 copies have been issued. For convenience use coupon below.



ACME

~for amplification

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Enclosed find 10c stamps or coin for my copy of "Amplification without Distortion."

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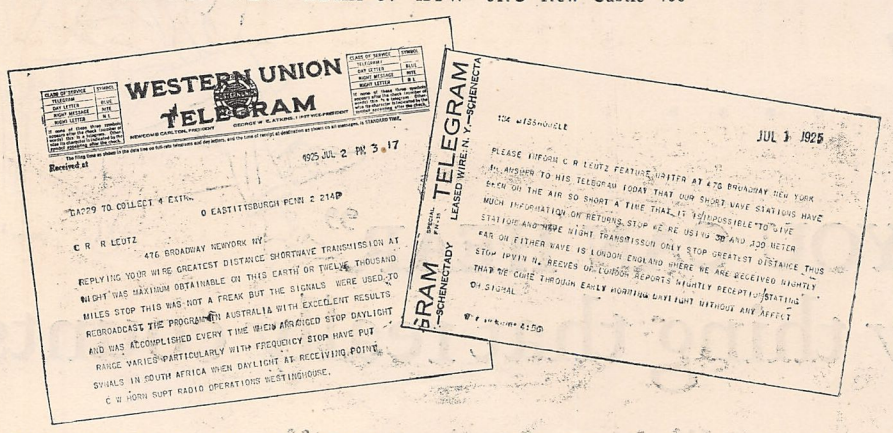
The Only Set That Tunes All Wave Lengths.

35 To 3600 METERS

3AR Melbourne 480—WGY 109—2FL Sydney 770—WKAQ San Juan 360—2BL Sydney 350—PCFF Amsterdam 2000 Karachi—Bombay—KOP—WGY 1660—6KW Tuinucu 340—Bankok—NSF Hilversum 1050—WLW—KDKA 64—KYW—5NO New Castle 400



WOC—CYL Mexico City 510—2FC Sydney 1100—KFI—PA5 Amsterdam 1050—Vienna—Colombo—WWJ—WCX Lakehurst 80—ICE Rome 470—5PY Plymouth 330—Voxhaus 430—CNRC Calgary 440—Madras—Stuttgart 437—BAV Brusse's 1100—6FL Sheffield 303—WGY 38—PCGG Hague 1050—Otchiski—KGW—CFAC 430—CHXC Ottawa—EBX Cartagena—NAA 2500—PCMM Ymuiden 1050—SBR Brussels 262—KHJ—LOX Palermo 375—OXE Lyngby 2400—KOA—2SB Sydney—OKP Kbely 1150—2BE Belfast 435—KGO—YN Lyons 470—I Nice 360—FL Eiffel Tower 2600—PTT Paris 450—5XX Chelmsford 1600—LZ Monte Grande 425—2LS Leeds 346—5MA Adelaide 850—2LO London 365—PWX Havana 400—RAS Vladivostok—WMBF—CJCM Mont Joli—LOR Buenos Aires 400—LP Berlin 2370—VTR Rangoon—3LO Melbourne 1720—6BM Bournemouth 385—5WA Cardiff 350—PRG Prague 1800—2ZY Manchester 375—HB2 Lausanne 850—JJC Funabashi—JSB Chemulpo—3FL Melbourne 400—6VL Liverpool 318—HBI Geneva 1100—KDKA 64—POZ Berlin 2800—2EH Edinburgh 325—5IT Birmingham 475—Munich 485—Leipzig 452—2BD Aberdeen 495.

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Six tube, 2 Stages Non-Regenerative Tuned Radio Frequency Amplification, Detector and 3 Stages Distortionless Radio Amplification. Receiving range from 1,000 to 12,000 miles depending upon location, station transmitting, wave-length received and other variable factors.

FULL DETAILS NOW AVAILABLE FROM MANUFACTURERS

GOLDEN-LEUTZ INC.

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6 Volt **Rubber Case**

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Shipped direct from factory to you. No middlemen's profit—no delays—no grief.

Send No Money

This is an actual 100 amp. Radio Storage Battery honestly built of purest materials by real battery builders. Solid Rubber Compartment cases—not wood (non-leakable)—will outlast the battery itself. Lead coated carrying handle. Wing binding posts.

Will operate the average 5 tube radio set from three to four hours daily for a month to six weeks.

NO DEPOSIT or Advance Payment Required

Simply order—and we will ship by express and you can examine battery at your express office to your heart's content. If you agree with us that it's the biggest offer ever made—pay the expressman $9.98 plus express charges.

If you prefer to remit with order—deduct 50c. You run no risk as we replace any defective battery during two years.

THOMAS BATTERY CORP., 511 West 50th St., New York, N.Y.

Trade Name: Pfanstiehl Model 10 Dial Six Overtone Receiver
Circuit: Pfanstiehl non-oscillating system of tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: One
List Price $155

* * *

Trade Name: Pfanstiehl Model 8-E Console
Circuit: Pfanstiehl non-oscillating system of tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price $135

* * *

Trade Name: Pfanstiehl Single Dial Six Overtone Receiver—Model 10 S—Double Duty Console
Circuit: Pfanstiehl non-oscillating system of tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $200

* * *

Trade Name: Pfanstiehl Single Dial Six Overtone Receiver—Model 10-C—Console Complete
Circuit: Pfanstiehl non-oscillating system of tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: One
List Price: $450

Manufacturer:
PHOENIX RADIO CORP.,
114 East 25th St.,
New York, N. Y.
Trade Name: Ultradyne Model L-3
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Indoor or Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $135

Manufacturer: PORTS MANUFACTURING CO.,
3305 E. Belmont Ave.,
Fresno, Calif.
Trade Name: Perkwell Super 5
Circuit: Tuned radio frequency
Batteries: Storage or dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $40

* * *

Trade Name: Pormco Radio
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $65

Manufacturer: THE PREMIER RADIO CORPORATION
Defiance, Ohio
Trade Name: Premier 8-A Console
Circuit: Reflex
Batteries: Storage
Antenna: Outdoor or loop
Loud Speaker: Built-in
Controls: Two
List Price: $350

* * *

Trade Name: Premier 7-A Console
Circuit: Reflex
Batteries: Storage
Antenna: Outdoor or loop
Loud Speaker: Built-in
Controls: Two
List Price: $290

* * *

Trade Name: Premier 7-B Table Type
Circuit: Reflex
Batteries: Storage
Antenna: Outdoor or loop
Loud Speaker: Separate
Controls: Two
List Price: $160

* * *

Trade Name: Premier 6-B Table Type
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaer: Separate
Controls: Three
List Price: $100

Manufacturer:
PRIESS RADIO CORP.,
693 Broadway,
New York City
Trade Name: Priess Straight Eight Model P. R. 4
Circuit: Priess
Batteries: Storage
Antenna: Loop
Loud Speaker: Separate
Controls: Two
List Price: $165

* * *

Trade Name: Priess Straight Eight Model P. R. 6
Circuit: Priess
Batteries: Storage
Antenna: Loop
Loud Speaker: Built-in
Controls: Two
List Price: $275

Manufacturer: RADIO MASTER CORPORATION OF AMERICA
Bay City, Mich.
Trade Name: "Simpliform" No. 10 Phono-Radio Combination
Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price $200

* * *

Trade Name: "Simpliform" No. 11 Phono-Radio Combination
Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $200

* * *

Trade Name: "Simpliform" No. 12 Phono-Radio Combination
Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $230

* * *

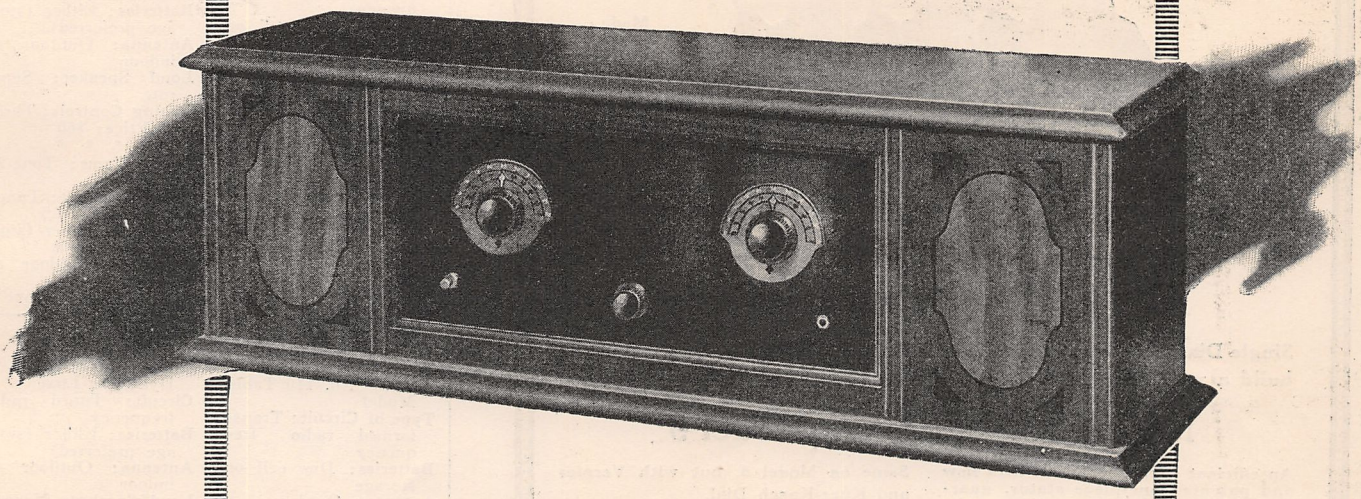
Trade Name: "Simpliform" 5T-1 Table Model
Circuit: Compensated tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $85

* * *

Trade Name: "Simpliform" 5T-14 Console
Type of Circuit: Compensated tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $125

Preliminary Announcement

ALL-AMERICAN RADIO RECEIVERS



Model R: Price $90.00

There will be available this fall a limited number of radio receivers, produced and wired complete in the new ALL-AMERICAN factory, and bearing the name ALL-AMERICAN.

Many hundreds of sets have been constructed in the ALL-AMERICAN laboratories. Most of them have performed in a manner which, in less experienced factories, would have caused the most joyful excitement. A few of these sets have shown results truly remarkable even when measured by the ALL-AMERICAN standard; but E. N. Rauland, pioneer in radio and severest critic of ALL-AMERICAN products, shook his head and said "Wait."

And he was wise. If this achievement had not come until next year, it would still have been worth waiting for. But it is on view at the shows.

Last year it was our pleasure to add to the family of the "World's Largest Selling Transformers" an audio amplifying instrument embodying features hitherto considered impractical, outside the laboratory, on account of their high cost. This transformer, *Rauland-Lyric*, has in one season revolutionized the tone-amplifying art. And now, in the same spirit, we offer the ALL-AMERICAN Receiver.

ALL-AMERICAN Receivers embody, necessarily, all the genuine improvements of the past year in radio reception—many of them the especial product of the ALL-AMERICAN laboratories. Multistage control through *two* 360° dials, *without gears*, the elimination of "body capacity," the extreme of beauty in tone through *Rauland-Lyric*, and of distance, power and selectivity through ALL-AMERICAN Straight-Line-Frequency TUNING—these are combined with the utmost beauty and permanence in external appointments.

And yet, ALL-AMERICAN Receivers are not high-priced. This is due to the fact that, although only a small number will be produced this fall, the price has been set on the basis of next year's extensive production.

Dealers who realize the significance, for future growth, of handling merchandise of this character, are invited to write their jobbers or the factory for full information, or to visit our booth at the Chicago or St. Louis radio shows.

ALL-AMERICAN RADIO CORPORATION, E. N. Rauland, *Pres.*, 4207 Belmont Ave., Chicago, U. S. A.

MEMBER RMA

OWNING AND OPERATING STATION WENR—266 METERS

ALL-AMERICAN

Pioneers in the Radio Industry

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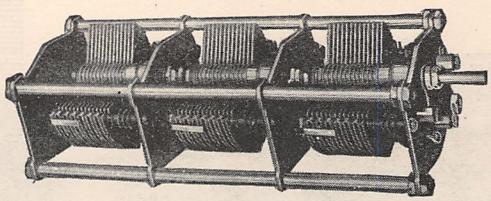
U.S.TOOL CONDENSERS



Made Under Hogan Patents Jan. 9, 1912 Pat. No. 1,014,002

MULTIPLE Condensers

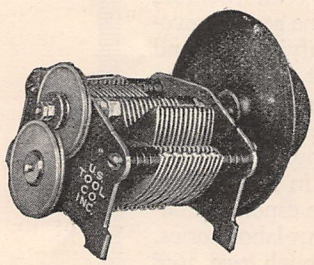
For Single Control Receivers

Single Dial Receivers are the Latest Improvement in Radio. You can build a very efficient set using the New U. S. Multiple Condensers.

Model 8

An efficient condenser made with new and patented one-piece stator, guaranteed to give sharp tuning at the lower broadcasting wave lengths.

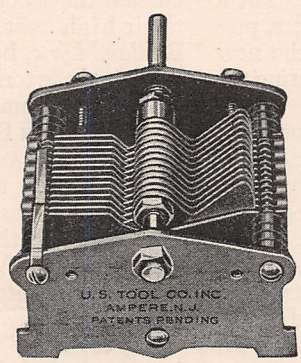
Capacity, Max. .00025, Min. .0000076....$2.70
Max. .00030, Min. .000008 .... 2.85
Max. .00035, Min. .0000086.... 2.95
Max. .00050, Min. .000011 .... 3.75



Model 9

Same as Model 8, but with Vernier and Kurz-Kasch Dial.

Capacity, Max. .00025, Min. .0000076....$3.75
Max. .00030, Min. .000008 .... 3.85
Max. .00035, Min. .0000086.... 4.10
Max. .00050, Min. .000011 .... 4.75



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"THE CATWHISKERS DELIGHT"

The BEST, bar none. For Crystal sets, "Silver Galena." For Reflex sets, "Placerite." Once tried, always used.

$1

40c Each, 3 for $1

Special for DeForest, 50c 70,000 users. You are next.

Dealers, write.

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FREE

Diagram for ultra-selective Crystal circuit free with 3 crystals at $1.

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Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

Trade Name: "Simpliform" 5T-15 Console
Type of Circuit: Compensated tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $150

* * *

Trade Name: "Simpliform" No. 100 Table Model
Type of Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $75

* * *

Trade Name: "Simpliform" No. 275 Console
Type of Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $110

* * *

Trade Name: "Simpliform" No. 110 Table Model
Type of Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $80

* * *

Trade Name: "Simpliform" No. 375 Console
Type of Circuit: Transformed radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $160

* * *

Trade Name: "Simpliform" 5T-215 Combination
Type of Circuit: Compensated tuned R.F.
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $250

Manufacturer: RAVEN RADIO COMPANY, Cobleskill, N. Y.
Trade Name: Raven 5-tube set
Type of Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $70

* * *

Trade Name: Raven Console Model
Type of Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $170

* * *

Trade Name: Raven set with built-in speaker
Type of Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $90

* * *

Trade Name: Raven Superheterodyne set unwired
Type of Circuit: ——
Batteries: Dry cell or storage
Antenna: Loop
Loud Speaker: Separate
Tuning Controls: Two
List Price: $125

Manufacturer: RESAS, INC. 112 Chambers St., New York City
Trade Name: Resas Tone-A-Dyne Compact
Type of Circuit: Tuned radio frequency
Batteries: Either (storage preferred)
Antenna: Outdoor or indoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $60

* * *

Trade Name: Tone-A-Dyne
Type of Circuit: Tuned radio frequency
Batteries: Either (storage preferred)
Antenna: Outdoor or indoor
Loud Speaker: None
Tuning Controls: ——
List Price: $78

* * *

Trade Name: Tone-A-Dyne De Luxe
Circuit: Tuned radio frequency
Batteries: Either (storage preferred)
Antenna: Outdoor or indoor
Loud Speaker: None
Tuning Controls: ——
List Price: $85

Manufacturer: SHERMAN RADIO MANUFACTURING CORP., 112 Trinity Place, New York City
Trade Name: Clearfield De Luxe
Type of Circuit: Tuned radio frequency with resistance coupled amplification
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $115

Manufacturer: SIMPLEX RADIO COMPANY, Rector and Main Sts., Manayunk, Philadelphia, Pa.
Trade Name: "Simplex" Type SR-5
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $57

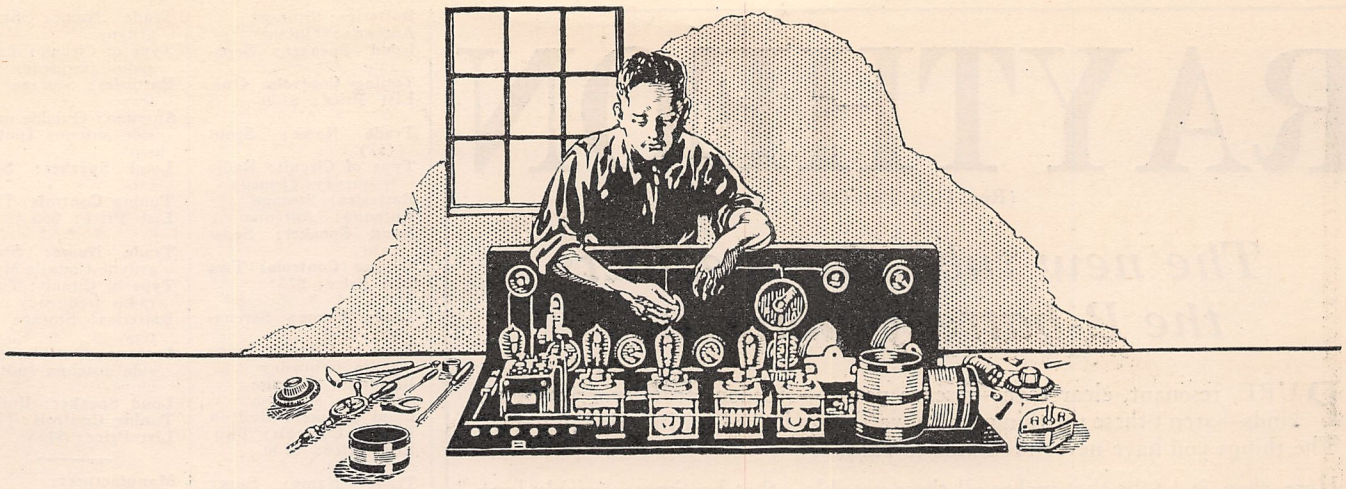
* * *

Trade Name: "Simplex" Type Sr-5 De Luxe
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $65

* * *

Trade Name: "Simplex" Type SR-8 Sloping Front
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $65

Manufacturer: SLEEPER RADIO CORP., 438 Washington Ave., Long Island City, N. Y.
Trade Name: Sleeper Monotrat (54)
Type of Circuit: Grimes Universe Duplex



Good Radio Requires Good Material

IT is just as impossible to build dependable radio with poor material as it is to build a good automobile or a good locomotive that way.

Formica panels, base panels, winding tubes, insulating bushings and washers have the qualities that make lasting durability possible.

They have electrical qualities that are more than sufficient for any need—and they combine with them equally essential mechanical strength, resistance to warping, and cold flowing. They never distort in use so that instruments are displaced.

The Formica finish is unequalled in richness and gloss. And that finish is one of the most permanent in the world. It does not discolor, grow dull, check or craze. No ordinary varnish or lacquer can equal it.

These are all things that count. They make or break the satisfaction a radio set will give. And that is why for years the great majority of radio manufacturers have used Formica.

VERI-CHROME PANELS

By the purchase of a controlling interest in the Veri-Chrome laboratories, the financial and production resources of the Formica Insulation Company have been placed behind this remarkable new process for decorating radio panels. Elaborate decorations can be produced much more rapidly and more economically than by engraving. Decorations designed by the leading American artists are offered. Tuning scales may be marked directly on the panel eliminating the standard dial and substituting pointers instead. The reduction in cost is large. Write for prices on complete panels finished in this way in quantity.

Dealers: Formica panels in individual envelopes furnish a line on which dealers make a very satisfactory profit.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

1 Formica is used by nearly all the leading set makers — and has for years been used by more set makers than any other material.

2 Formica is unaffected by weather and time — it lasts forever.

3 Formica in appearance is the finest of all panel materials and always remains so.

4 Formica's electrical qualities of every kind far exceed any possible requirement.

5 Formica has high mechanical strength and will not break in use.

6 Formica will not sag from heat or cold flow under pressure. It retains its dimensions. Everything you fasten to it stays tight and precisely where you put it.

7 Formica panels are sold in neat craft paper envelopes which assure you that you are getting the genuine.

8 Formica is one of the most widely approved materials in radio.

SALES OFFICES

50 Church Street.....New York, N. Y.
9 South Clinton Street.....Chicago, Ill.
516 Caxton Bldg.....Cleveland, Ohio
327 Cutler Bldg.....Rochester, N. Y.
422 First Avenue.....Pittsburg, Pa.
6 Beacon Street.....Boston, Mass.
55 Calle Obispo.....Habana, Cuba
1026 Second Avenue.....Minneapolis, Minn.
725 Bulletin Bldg.....Philadelphia, Pa.
708 Title Building.....Baltimore, Md.
585 Mission Street.....San Francisco, Cal.
419 Ohio Building.....Toledo, Ohio
309 Plymouth Bldg.....New Haven, Conn.
Whitney Central Bldg.....New Orleans, La.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Hear the Formica Orchestra over WLW every Tuesday evening from 9 to 10 Central Standard Time.

RAYTHEON

(Reg. U. S. Pat. Off.)

The new tube that perfects the B-battery eliminator

PURE, resonant, clear tone—reserve power—freedom from worries of all kinds—aren't these the things you have always looked for in a B-eliminator? The things you have never been able to realize?

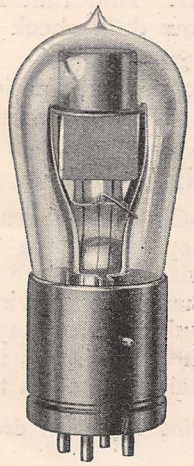
Here, then, is a tube that makes all these possible—that has immeasurably long life, uniform quality, ample power to run a 10-tube set. The RAYTHEON Rectifier is the result of prolonged experimentation and scientific research. It is the last word in the perfection of the B-battery eliminator, developed by an organization that is in the forefront of the engineering field, and endorsed by radio editors and leading manufacturers.

You can buy specially designed B-battery eliminators equipped with the RAYTHEON Rectifier at your dealers'. RAYTHEON Rectifying Tubes and specially designed parts for use in building your own B-eliminator are also obtainable from your retailer. Price of tube, $6.

Look for the RAYTHEON name. It is the mark of quality and your assurance of satisfaction.

Long Life

Replacements Unnecessary



Reserve Power

Uninterrupted Service

AMERICAN APPLIANCE CO.

Cambridge, Massachusetts

Organization Integrity—Honest Merchandising—Truthful Advertising
Scientific Research—Sound Engineering—Basic Patents—Substantial Backing

Any Radio Map or Log a Month Old Is

Out Of Date

Unless It Has a Monthly Supplemental Service

THE AIR-LINE RADIO MAP AND LOG

With Patented Movable Mile Scale has this Service

Lists stations by dial letters also by wave-lengths. **Unique Broadcasting Schedule.** Log shows location; difference in time; power, meters and kilocycles; Spaces to list dial settings; time heard, distance, signal strength. Whether you use outdoor aerial or loop, direction of loop; phones or loud speaker.

AN INDIVIDUAL LOG FOR EVERY STATION

If you do not find this the most complete servicable RADIO MAP and LOG published, we will refund your money.

PRICE 50 CENTS

At your dealers, or sent postpaid. Dealers and Jobbers Write at once

MULTIVIDER CO. St. John & Askew, Kansas City. Mo.

Reg. U.S. Pat. Office

Lincoln RADIO PRODUCTS

Collapsible LOOP AERIALS

Popular Prices—Remarkable Results

No better loops at any price. Quantity production keeps prices low. Handsome, convenient and efficient.

LINCOLN 4-POINT TAPPED LOOP . . . $8.00
Built for any circuit where i tis desired to vary the inductance of the loop. Exceptionally fine for Superhets.

LINCOLN CENTER-TAPPED LOOP . . . $6.50
For any set employing radio frequency amplification. For certain Superhets requiring a center tap. If your dealer cannot supply you, order direct, giving your dealer's name. Write for illustrated catalog RN.

LINCOLN RADIO CORPORATION, 224 N. Wells St., Chicago

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Batteries: Storage
Antenna: Outside
Loud Speaker: Separate
Tuning Controls: One
List Price: $130

* * *

Trade Name: Scout (57)
Type of Circuit: Radio frequency (Juneo)
Batteries: Storage
Antenna: Antenna
Loud Speaker: Separate
Tuning Controls: Two
List Price: $75

* * *

Trade Name: Serenader (58)
Type of Circuit: Juneo radio frequency
Batteries: Storage
Antenna: Antenna
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $100

* * *

Trade Name: Super Symphonetic (59)
Type of Circuit: Juneo radio frequency.
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $150

Manufacturer: SPLITDORF ELECTRICAL COMPANY, 392 High St., Newark, N. J.
Trade Name: Splitdorf Sonata
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outside antenna
Loud Speakers: Separate
Tuning Controls: Two
List Price: $60

* * *

Trade Name: Splitdorf Polonaise
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Tuning Controls: Three
List Price: $75

* * *

Trade Name: Splitdorf Nocturne
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in speaker and compartment for "B" batteries
Tuning Controls: Three
List Price: $150

* * *

Trade Name: Splitdorf Geisha
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Tuning Controls: Three
List Price: $110

* * *

Trade Name: Splitdorf Rhapsody
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in speaker and compartment for "B" batteries
Tuning Controls: Three
List Price: $410

* * *

Trade Name: Splitdorf Mikado
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in speaker and compartment for "B" batteries
Tuning Controls: Three
List Price: $425

Manufacturer: STANDARD RADIO CORP., 41 Jackson St., Worcester, Mass.
Trade Name: Standardyne
Type of Circuit: Tuned radio frequency
Batteries: Storage battery
Antenna: Outside or inside antenna (not on loop)
Loud Speaker: Separate
Tuning Controls: Three
List Price: $60

* * *

Trade Name: Standardyne-Console Model
Type of Circuit: Tuned radio frequency
Batteries: Storage battery
Antenna: Outside or inside antenna (not on loop)
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $135

Manufacturer: SONORA PHONOGRAPH CO., INC., 279 Broadway, New York City
Trade Name: Sonora Model C Receiver
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outside antenna
Loud Speaker: Separate
Tuning Controls: Three
List Price: $90

* * *

Trade Name: Sonora Model C Highboy
Type of Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outside antenna
Loud Speaker: Built-in
Tuning Controls: Three
List Price: $90

Manufacturer: STEINITE LABORATORIES, Atchinson, Kansas
Trade Name: Steinite
Type of circuit: Crystal
Batteries: None
Antenna: Outside
Loud Speaker: None
Tuning Control: One
List Price $6

* * *

Trade Name: Steinite
Type of Circuit: Crystal
Batteries: Storage
Antenna: Outside
Loud Speaker: Separate
Tuning Controls: Three
List Price: $50 and $60

Manufacturer: SPIELMAN ELECTRIC CO., 311 West 59th St., New York City, N. Y.
Trade Name: Air Pilot
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Tuning Controls: Three
List Price: $60

* * *

Trade Name: Comet
Batteries: Storage
Antenna: Both
Loud Speaker: Separate
Tuning Controls: Three
List Price: ———

Manufacturer: SUN MANUFACTURING CO., 26th and Maple Sts., Louisville, Ky.
Trade Name: Sun Radio
Type of Circuit: Tuned radio frequency reflexed
Batteries: Storage
Antenna: Outside
Loud Speaker: Separate
Tuning Controls: Three
List Price: $75

* * *

Trade Name: Sun Radio DeLuxe

RADIO 'RITHMETIC

"A" batteries + "B" batteries + RECTIGON = clear radio reception

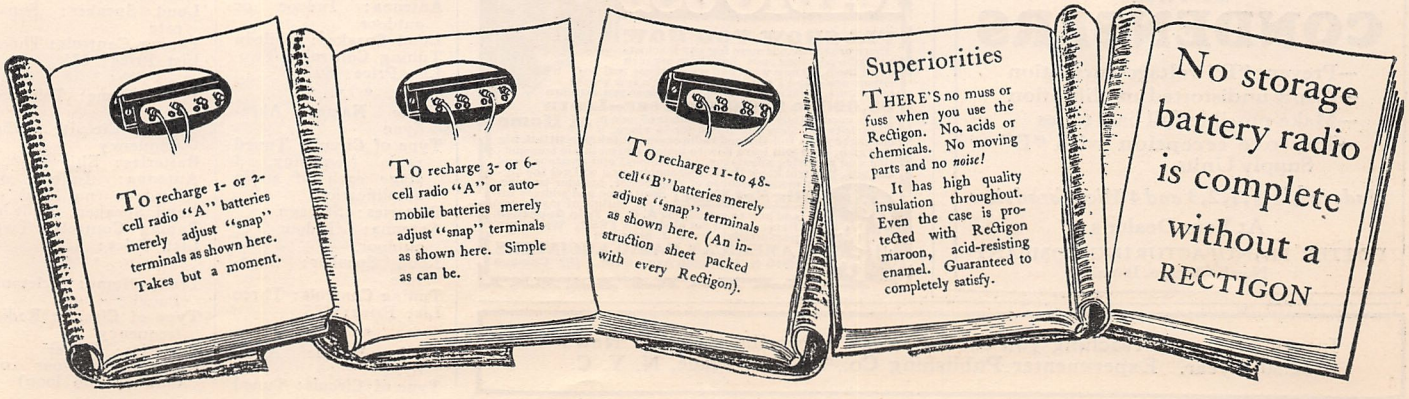
HARK back to your old arithmetic and those busy boys "A" and "B". They were forever doing "a certain piece of work". They're still inseparable. Nowadays "A" and "B" storage batteries are busy with clear radio reception.

"A" still depends upon "B" and vice versa. Both need to be kept fully alive to do their best work. Both *can* be kept alive easily and dependably through the use of *one* [*did you know that?*] compact, little device—

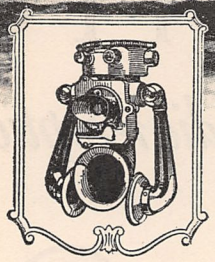
The Westinghouse Rectigon Battery Charger

APPROVED RADIO NEWS LABORATORIES 1922

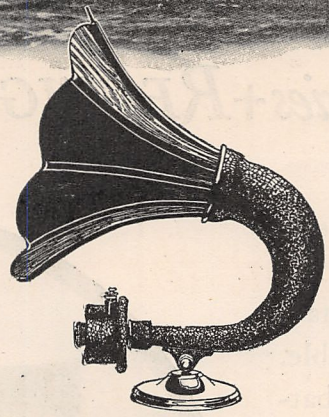
© 1925, W. E. & M. Co.



The clear tone of The Amplion comes from 30 years' experience in creating loud speakers



Distinct voicing of commands at sea is vital! At left, one of the naval loud speakers produced by the Amplion organization and installed on over 12,000 ships of leading navies and shipping companies throughout the world.



Clarity is also essential to full enjoyment of radio. Thirty years' experience in creating loud speakers, unrivaled for clearness of tone, evolved The Amplion. Ask to hear the improved new Amplion Dragon, AR-19, illustrated above.

ALL who hear the Amplion are won by its wonderful clearness and deep, full, life-like tone-qualities which have made it the world's largest-selling loud speaker.

The explanation is that The Amplion was evolved by the actual originators and oldest producers of loud speakers.* Long before radio attained general popularity, Graham loud speakers had been adopted—because of outstanding excellence—by the exacting British Admiralty and naval experts of other nations. The Amplion, introduced in 1920, was based on thirty years of successful experience.

Hear The Amplion in comparison with any or all other radio reproducers. Let your ears tell you why it is so widely known as "The world's finest loud speaker." Amplion Loud Speakers, $12 up. Phonograph units in two sizes. Interesting literature and dealer's address on request.

THE AMPLION CORPORATION OF AMERICA
Executive Offices: Suite S, 280 Madison Ave., New York City
Canadian Distributors: Burndept of Canada, Ltd., Toronto
*Alfred Graham & Co., London, England, Patentees

The supremacy of The Amplion has won world-wide recognition and leadership in sales. Partial list of nations in which Amplions are ruling favorites among music-lovers·

UNITED STATES
DOMINION OF CANADA
ENGLAND
SCOTLAND WALES
IRELAND
NORWAY SWEDEN
DENMARK
HOLLAND BELGIUM
FRANCE SPAIN
SWITZERLAND
ITALY JAPAN
SOUTH AFRICA
NEW ZEALAND
AUSTRALIA

AMPLION
The World's Standard Loud Speaker

Potter
BY-PASS
CONDENSERS
—Prevent "B" voltage fluctuation
—Allow undistorted amplification
—Make possible full bass tones
—Improve reception with "B" Supply Units.

Made in $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 3 and 4 Microfarad sizes

At Your Dealer's

POTTER MANUFACTURING COMPANY
North Chicago, Illinois

Get the BIG PAY RADIO Job

I'LL SHOW YOU HOW
There are thousands more big pay fascinating radio positions open than there are men to fill them. I know what and where these real positions are—and I can qualify you, in a few weeks spare time, to fill one of these positions so you can earn
$3,000 to $10,000 a Year—Learn at Home
Electricity, Wireless and Radio for 15 years. I have successfully trained thousands of men in can make you a full-fledged radio expert **quickly**; a titled, big pay man. You will learn how to install and maintain transmitting and receiving apparatus, professional and amateur, land and sea. You will know Radio thoroughly—and will get the bigger money because of your better, broader training.
Big Set Free! Send name and address for a full outline of my course and how to get the big A. R. E. Twin Superdon Experimental Set absolutely FREE. Write me personally! Irwin J. Mendels.
AMERICAN RADIO ENGINEERS
646 N. Michigan Ave., Dept. 107 Chicago

Get My Book Free

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Type of Circuit: Tuned radio frequency reflexed
Batteries: Either
Antenna: Outside
Loud Speaker: Separate
Tuning Controls: Three
List Price: $100

* * *

Trade Name: Sun Radio
Type of Circuit: Tuned radio frequency reflexed
Batteries: Either
Antenna: Outside
Loud Speaker: Both
Tuning Controls: Three
List Price: $140

* * *

Trade Name: Sun Radio & Phonograph
Type of Circuit: Tuned radio frequency reflexed
Batteries: Either
Antenna: Outside
Loud Speaker: Phonograph and radio combination
Tuning Controls: Three
List Price: $237.50

* * *

Trade Name: Super-Sun
Type of Circuit: Radio frequency and special (our own)
Batteries: Dry cells
Antenna: None
Loud Speaker: Separate
Tuning Controls: Two
List Price: $125

Manufacturer: SUN-BEAM RADIO CORP.,
350 West 31st St.,
New York City

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $175

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $215

* * *

Trade Name: Akradyne
Type of Circuit: Three stage each of audio amplification and tuned radio frequency
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $475

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $975

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Separate
Tuning Controls: Three
List Price: $75

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Separate
Tuning Controls: Two
List Price: $90

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $110

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 2 stage each of audio amplification
Batteries: Storage
Antenna: Indoor or outdoor.
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $150

* * *

Trade Name: Akradyne
Type of Circuit: Tuned radio frequency, 3 stage each of audio amplification
Batteries: Storage
Antenna: Both
Loud Speaker: Built-in
Tuning Control: Two
List Price: $1,475

* * *

Trade Name: Pink-a-Tone
Type of Circuit: Tuned radio frequency reflexed
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Two
List Price: $18.50

* * *

Trade Name: Pink-a-Tone
Type of Circuit: Tuned radio frequency reflexed
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Two
List Price: $28.50

* * *

Trade Name: Pink-a-Tone
Type of Circuit: Tuned radio frequency reflexed
Batteries: Dry cell
Antenna: Outside
Loud Speaker: Separate
Tuning Controls: Three
List Price: $34.50

Manufacturer: TELETONE CORP.
449 W. 42nd St.,
New York City

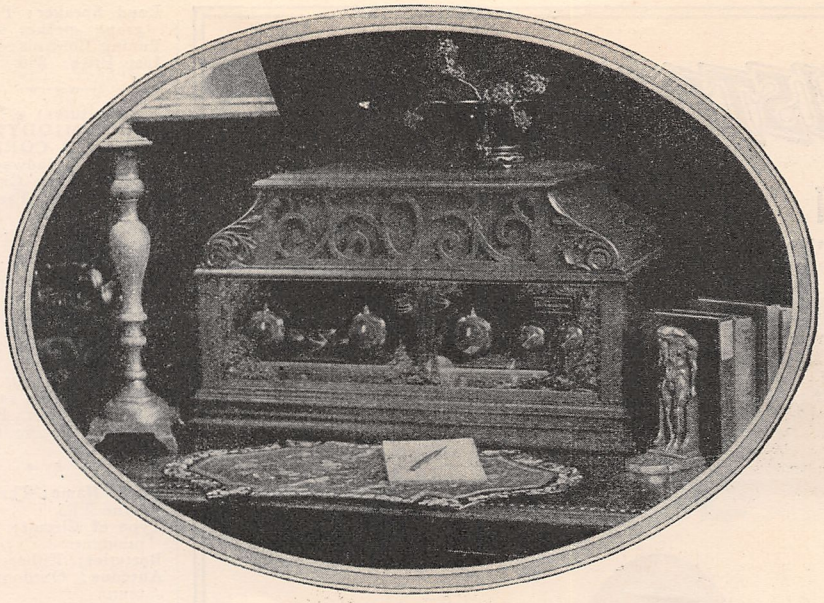
Trade Name: Teletone R.F.
Type of Circuit: Radio frequency
Batteries: Either
Antenna: Outside or indoor (no loop)
Loud Speaker: Separate
Tuning Controls: Three
List Price: $75

* * *

Trade Name: Teletone Tudor
Type of Circuit: Radio frequency
Batteries: Either
Antenna: Indoor or outdoor (no loop)
Loud Speaker: Built-in
Tuning Controls: Two
List Price: $200

* * *

Trade Name: Teletone Panel
Type of Circuit: Radio frequency
Batteries: Either
Antenna: Indoor or outdoor (no loop)



And now the final radio set

—the Deresnadyne operating from the light socket

A complete receiver employing no batteries

FOR those who want a radio receiver second to none, both in convenience and performance, the Deresnadyne will settle the question of which set to buy. It is a complete set requiring no added equipment. A set installed by merely plugging in the light socket. A set requiring no attention and always ready to operate at full power. A set which does not choose between tone quality and volume, nor between selectivity and distance, but combines all four qualities of a superlative radio receiver.

The Deresnadyne employs no batteries. It is equipped with a power unit which furnishes all necessary current from the light socket. This unit is an adaptation of one of the most successful power devices in radio. It is entirely noiseless—a permanent piece of equipment, with no bulbs and nothing to adjust, wear out, replace, recharge or renew. It improves reception for it performs at all times exactly as do batteries when these are new and fully charged.

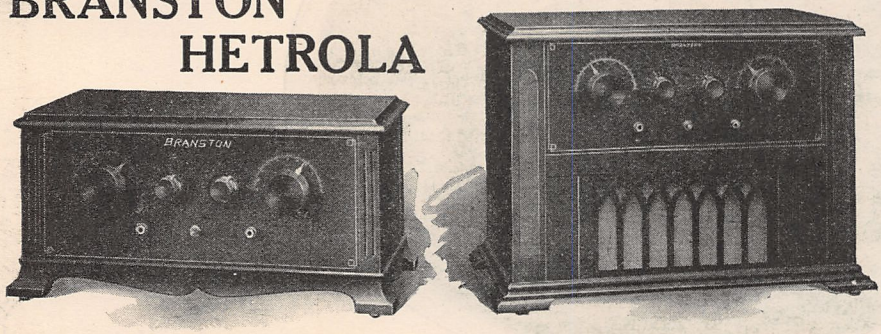
The Deresnadyne includes all accessories except tubes. Its compactness has made possible radical improvements in appearance. The power unit and speaker are included in the cabinet. There is nothing more to buy and no further expense other than household current (110-120 AC 60 cycle)—about 1/10¢ per hour of actual use. The only connection you need make is the ground wire. Price $365. See it at your dealer's. See also the Deresnadyne II at $125 and III at $165, receivers employing the Deresnadyne circuit but requiring the usual battery and aerial equipment.

Andrews
Deresnadyne
Radio Receiving Set

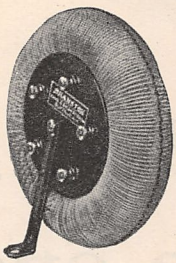
ANDREWS RADIO CORPORATION · 1414 S. WABASH AVENUE · CHICAGO

BRANSTON RADIO

BRANSTON HETROLA



Model R-46 complete with handsome walnut cabinet ready for tubes and batteries—**$75.00**



Model R-47. Table console type in walnut with self-contained loud speaker and battery compartment—**$120.00**

The latest development in radio—the HETORUS Coil—illustrated above is now offered to you completely built up in beautiful sets designed for the utmost satisfaction in radio reception.

Two dials only, making for easy tuning by the most inexperienced—all wiring below the base panel.

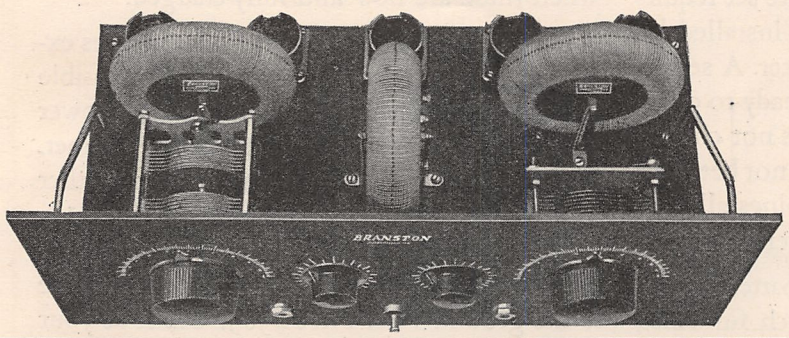
Increased selectivity, improved tone and volume, more compact design, and A MARKED DECREASE IN STATIC are some of the main advantages of this new method of coil construction.

The HETORUS Coil has no pick-up quality of its own, affording a new and better means of separating closely allocated stations.

It is sold singly at $2.50 or in a matched set of three at $7.50. Three coils and three straight line frequency condensers $15.00. Complete set, wired but without cabinet shown below, **$55.00.**

Whether you build, rebuild, or buy—use HETORUS coils for best possible results in tuned radio frequency reception. Write at once for full information on this outstanding sensation.

CHAS. A. BRANSTON, Inc.
817 Main Street, Buffalo, N. Y.

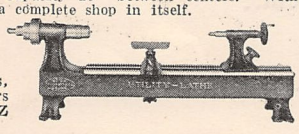


Buy Now Pay Later!

You Radio Men Need This Lathe!
Do your turning, drilling, threading, sawing, sanding, grinding and jig sawing on the

Boice-Crane Utility Lathe

Swings 8". Capacity 20" between centers. With attachments—a complete shop in itself. Write for circular on the Utility Lathe and Boice-Crane Circular Saws, Band Saws, Jointers and the Boice E-Z Pay Plan.



W. B. & J. E. Boice, Dept. 811-A **Toledo, O.**

Aeriola X Crystal Set

$12 *Complete with*

100 ft. aerial wire, 35 ft. ground and lead-in wire, aerial insulators, procelain tube, lead-in strip, ground clamp, nail-tite knobs, set head phones. (Without accessories, $6.00.)

MONEY BACK GUARANTEE
Send for FREE Descriptive Booklet.

CRAIN BROS. RADIO SHOPPE
2304 Telegraph Avenue : : Oakland, Calif.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will.

Price 65c.

Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York

Loud Speaker: Phonograph speaker used.
Tuning Controls: Two
List Price: $90

Manufacturer: THERMIODYNE RADIO CORP. 1819 Broadway, New York City
Trade Name: Thermiodyne TF6
Type of Circuit: Thermiodyne
Batteries: Either
Antenna: Indoor or outdoor
Loud Speaker: Separate
Tuning Control: One master control
List Price: $150, Central & Eastern States; $160, Rocky Mt. & Pacific Coast States

* * *

Trade Name: Thermiodyne TF5
Type of Circuit: Thermiodyne
Batteries: Either
Antenna: Outdoor antenna
Loud Speaker: Separate
Tuning Control: One master control
List Price: $100, Central & Eastern States; $110, Rocky Mt. & Pacific Coast States

* * *

Trade Name: Thermiodyne CTF6
Type of Circuit: Thermiodyne
Batteries: Either
Antenna: Indoor or outdoor
Loud Speaker: Built-in
Tuning Control: One master control
List Price: $275, Central & Eastern States; $290, Rocky Mt. & Pacific Coast States

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Manufacturer: R. E. THOMPSON MFG. CO., 30 Church St., New York City, N. Y.
Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Either
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $180

* * *

Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $145

* * *

Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $125

* * *

Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Either
Antenna: Antenna
Loud Speaker: Built-in
Tuning Control: One
List Price: $360

* * *

Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Tuning Control: One
List Price: $150

Trade Name: Thompson
Type of Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $125

Manufacturer: TRESCO-ATCHINSON, Atchinson, Kans.
Trade Name: Steinite
Type of Circuit: Armstrong regenerative
Batteries: Both
Antenna: Outside
Loud Speaker: Separate
Tuning Control: One
List Price: $6

* * *

Trade Name: Steinite
Type of Circuit: Armstrong regenerative
Batteries: Both
Antenna: Outside
Loud Speaker: Separate
Tuning Control: One
List Price: $12.50

Manufacturer: WALBERT MFG. CO. 925-41 Wrightwood Ave., Chicago, Ill.
Trade Name: Isofarad
Type of Circuit: Balanced capacity bridge
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $200

* * *

Trade Name: Isofarad, Jr.
Type of Circuit: Balanced capacity bridge
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Tuning Controls: Three
List Price: $150

Manufacturer: WELLS RADIO MFG. CO. 2708-12 North Ashland Ave., Chicago, Ill.
Trade Name: Wells Bear Cat Model V
Circuit: Radio frequency
Batteries: Dry cell
Antenna: Outside
Loud Speaker: Built-in
Controls: Three
List Price: $110.00

* * *

Trade Name: Wells Bear Cat Model 50
Circuit: Radio frequency
Batteries: Dry cell
Antenna: Outside
Loud Speaker: Separate
Controls: Three
List Price: $95.00

* * *

Trade Name: Wells Bear Cat Portable Model 500
Circuit: Radio frequency
Batteries: Dry cell
Antenna: Outside
Loud Speaker: Built-in
Controls: Three
List Price: $110.00

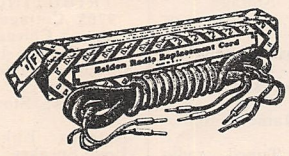
Manufacturer: WESTERN COIL & ELECTRICAL CO., 300 5th St., Racine, Wis.
Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outside
Loud Speaker: Built-in
Controls: Three
List Price: $185.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency Radiodyne
Batteries: Storage

Make it a GOOD Set by Using Belden Products

Flexible, bare, and insulated hook-up wires of all kinds.



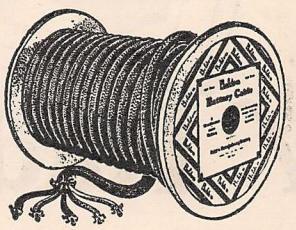
Replacement and extension cords.

Hook-up wires in several colors for easy wiring.

TWO things are important when you build a radio set: First, the workmanship in arranging and connecting the units, and second, the the quality of material used.

No amount of good workmanship can compensate for poor material. For this reason, Belden radio products are used by many of the largest radio manufacturers. Belden radio products are available to you, too, in handy cartons, each labeled and guaranteed for your protection. There are dozens of items, each designed especially for some place in your circuit. Our attractive booklet, "Helpful Hints for Radio Fans," describes them all, with diagrams and illustrations. Every set builder should have this booklet.

Send for Free Illustrated Booklet



Use this battery cable if your batteries are in the basement.

Magnet Wire in all sizes for the man who winds his own coils.

BELDEN MANUFACTURING CO.
2314F South Western Ave., Chicago

Please send me your booklet entitled "Helpful Hints for Radio Fans."

Name.....

Address.....

Belden

THE HOUSE BEHIND THE CATALOG

YOU'VE seen this slogan in our advertisements: "The Largest Radio Store in America." Of course, there are larger concerns handling radio—*but not exclusively.* Perhaps we should say: "The Largest *Exclusively Radio* Store in America." Every square foot of floor space in our building (shown in this advertisement) is devoted to storing our enormous Radio Stock. We employ more than 60 experienced radio men to serve you and our million other radio customers. Ever since 1915, when we started, our policy has been: real service backed by an iron-clad guarantee of satisfaction.

Salvage means: Save: Service: Satisfaction

FREE

This Super of Radio Catalogs

NOTHING but the latest—and the best, too! You'll find the best kits for all the latest hook-ups fully described and illustrated in our new 96 page "Super" Radio Catalog.

We save you money, too! Our enormous buying power permits us to pay spot cash and get rock-bottom prices. This new catalog illustrates and describes a complete line of fully guaranteed parts and accessories.

Send for your FREE copy, today!

CHICAGO SALVAGE STOCK STORES

509 SOUTH STATE STREET Dept. RN. CHICAGO, U. S. A.

NA-ALD

Na-ald DeLuxe Sockets are the only ones with these three exclusive features—lowest loss, lowest capacity and positive side-scraping contact. Send for booklet and laboratory test. **Alden Manufacturing Company, Dept. K11, Springfield, Mass.**

WADE SQUARE LAW CONDENSER AND DIAL

All sizes, complete with 4-inch vernier dial, for:
Short wave .000125 mfd. $7.50
Tuned Radio Frequency, .00025 mfd. 7.75
Super-Heterodynes .0005 mfd. 8.00
At your dealers, otherwise send purchase price and you will be supplied postpaid.
WADE MFG. CO., Inc., 1819-A Broadway, N. Y. City

for Improved Reception—
—build with FIL-KO-PARTS
Cut down interference and get stations you never heard before through scientific tube tuning. Ask your dealer, or write to Dept. RN 11 25.
D X INSTRUMENT CO. Harrisburg, Pa.
FIL-KO-PARTS

"Lighting Fixtures"
READY TO HANG
(Direct from Manufacturer)
Completeely wired including glassware
Send for new Catalogue No. 27
(Just reduced prices)
Special Proposition to Dealers
ERIE FIXTURE SUPPLY CO.
STATION R ERIE, PA.

Antenna: Inside or outside
Loud Speaker: Separate
Controls: Two
List Price: $39.50

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outside
Loud Speaker: Separate
Controls: Three
List Prcie: $110.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $210.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $65.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $85.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $185.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Indoor or outdoor
Loud Speaker: Separate
Controls: Two
List Price: $39.50

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor and indoor
Loud Speaker: Separate
Controls: Two
List Price: $75.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Indoor or outdoor
Loud Speaker: Separate
Controls: Two
List Price: $100.00

* * *

Trade Name: Radiodyne
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Indoor or outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $215.00

Manufacturer: WILCOX LABS, Lansing, Mich.
Trade Name: Wilcox Hexaircoil
Circuit: Tuned radio frequency
Batteries: Storage battery preferred
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $88.00

* * *

Trade Name: Wilcox
Circuit: Tuned radio frequency
Batteries: Storage battery preferred
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $140.00
Manufacturer: W-K ELECTRIC COMPANY, 89 Middle Street, Kenosha, Wis.
Trade Name: Oriole Model 5
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Either or ground wire only
Loud Speaker: Separate
Controls: Two
List Price: $90.00

* * *

Trade Name: Oriole Model 6
Circuit: Tuned radio frequency
Batteries: Storage battery, and "B" battery compartment
Antenna: Either or ground wire only
Loud Speaker: Separate
Controls: Two
List Price: $100.00

* * *

Trade Name: Oriole Model 7
Circuit: Special patented circuit
Batteries: Storage
Antenna: Either or ground wire only
Loud Speaker: Separate
Controls: Two
List Price: $150.00 less accessories

* * *

Trade Name: Oriole Model 8
Circuit: Special patented circuit
Batteries: Storage
Antenna: Outside antenna and ground
Loud Speaker: Separate
Controls: Two
List Price: $65.00 less accessories

Manufacturer: UNITED MANUFACTURING & DISTRIBUTING CO., 9705 Cottage Grove Ave., Chicago, Ill.
Trade Name: Unidyne 4
Circuit: Tuned radio frequency
Batteries: Storage battery
Antenna: Either
Loud Speaker: Separate
Controls: Two
List Price: $75.00

* * *

Trade Name: Super-Unidyne 4
Circuit: Tuned radio frequency
Batteries: Storage battery
Antenna: Either
Loud Speaker: Separate
Controls: Three
List Price: $130.00

Manufacturer: L. D. VAN VALKENBURG CO., Holyoke, Mass.
Trade Name: "Van" Fixed Crystal Receiver
Battery: None
Antenna: Outside
Loud Speaker: None
Control: One
List Price: $4.00

Manufacturer: YALE RADIO ELECTRIC CO., 1111 Wall St., Los Angeles, Calif.
Trade Name: Yale-Premier
Circuit: Tuned radio frequency — navy licensed
Batteries: Either
Antenna: Outdoor
Loud Speaker: Separate
Controls: Three
List Price: $50.00

* * *

Trade Name: Yale-Premier
Circuit: Tuned radio frequency — Navy licensed
Batteries: Either
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three

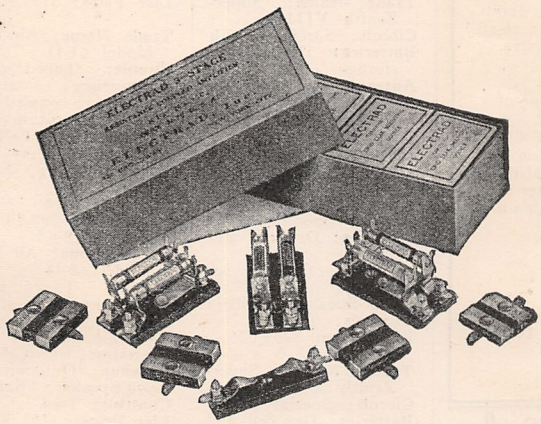
Gives Your Tuner A Man Sized Voice

NOW—you can enjoy loud speaker reproduction with your favorite tuner.

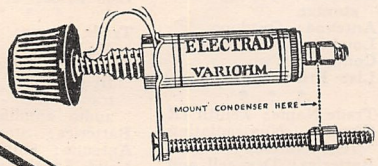
Using the "Electrad" 3-Step Resistance Coupled Amplifier Kit it's easy and economical to build an amplifier unit. And you will get a clarity and fidelity of tone unequalled by any other amplifying method.

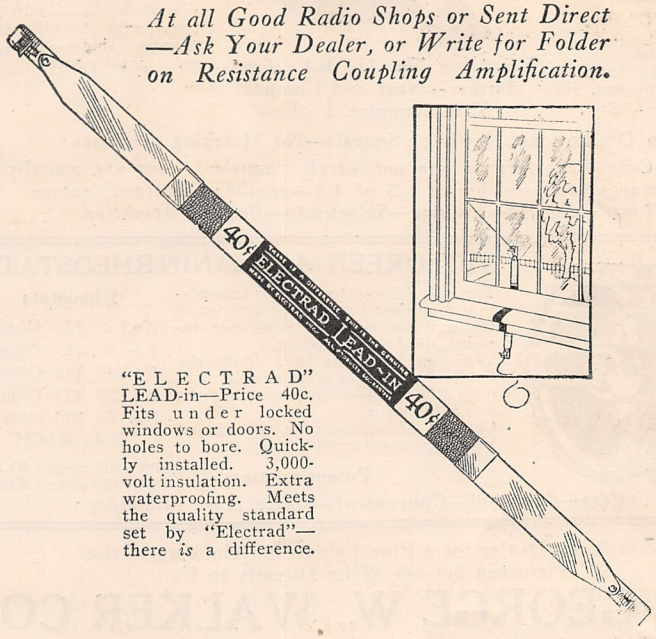
"ELECTRAD" 3-STEP RESISTANCE COUPLED AMPLIFIER KIT No. 1-C—A Big $6.75 value. Contains the necessary Resistor Couplers, Certified Mica Condensers, Condenser mounting, Certified Grid Leaks and Resistors. Nothing else needed except sockets, rheostat and bus bar.

At all Good Radio Shops or Sent Direct —Ask Your Dealer, or Write for Folder on Resistance Coupling Amplification.



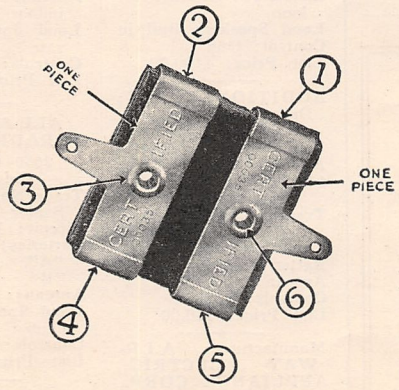
"ELECTRAD" VARIOHM—Price $1.25. Gives that much desired last hair's breadth tuning, clears up DX reception. Gives any resistance from ¼ to 30 megohms. Mounted $1.50.





"ELECTRAD" LEAD-in—Price 40c. Fits under locked windows or doors. No holes to bore. Quickly installed. 3,000-volt insulation. Extra waterproofing. Meets the quality standard set by "Electrad"—there *is* a difference.

ELECTRAD



"The Six Point Pressure Condenser"

THE "Electrad" Certified Fixed Mica Condenser is a revelation in accuracy and design. Ingenious, rigid binding and firm riveting fastens parts securely at Six different points insuring positive electrical contact. Impervious to temperature and climatic variations. Exerts even pressure upon the largest possible surface—can't work loose. Binding strap and soldering lug in one piece. Accuracy and quietness assured always. Value guaranteed to remain within 10% of calibration. Standard capacities, 3 types. Licensed under Pat. No. 1,181,623, May 2, 1916, and applications pending. Price 30c to 75c in sealed dust and moisture proof packages.

ELECTRAD, Inc.

428 Broadway **New York City**

Also makers of other handy radio essentials—Certified Grid Leaks, Audiohms, Lighting Arresters, Lamp Socket Antenna and many others.

Be Prepared to Tune in European Stations During the Trans-Atlantic Test Period This Coming Season

Use a

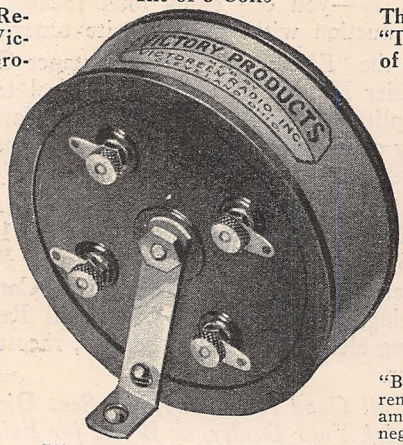
VICTOREEN SUPER HETERODYNE KIT

$33.50

Kit of 5 Coils

Additional Parts Required to Build a Victoreen Super Heterodyne:

2—.0005 Variable Condensers.
8—Vacuum Tube Sockets.
2—.00025 Grid Condensers with Mounting.
2—2 MEG Grid Leaks.
1—400 OHM Potentiometer.
2—30 OHM Rheostats.
2—6 OHM Rheostats.
2—Double Circuit Jacks.
1—Single Circuit Filament Jack.
1—Filament Switch.
2—Audio Transformers.
1—1MFD. Bypass Condenser.
1—4½ Volt "C" Battery.
1—7x24-in. Panel.
Base Board 8¾x23x⅜.
Binding Post, Screws, Bus Bar and Solder Lugs.



Victoreen No. 170 R.F. Transformer—Neat and Compact 3" in diameter, 1" thick

The Victoreen Kit—"Type OM"—Consists of:

3—"Victoreen" No. 170 R.F. Transformers.
1—"Victoreen" No. 175 Input Transformer.
1—"Victoreen" No. 150 Oscillator Coil.

Should use of Aerial be preferred to Loop, the "Victoreen" No. 160 Antenna Coupler is required, at $3.50 Extra.

Either

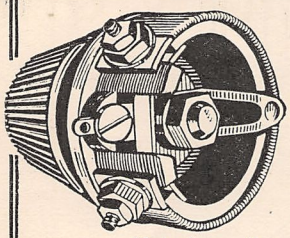
UV199 or 201A Type of Tubes may be used. A truly Victoreen Feature.

"B" Battery consumption is remarkably low—8-10 Milliamps, with Potentiometer at negative side—less than some 3 tube sets.

No Oscillations, Howls or Squeals—No Matching of Tubes.

Victoreen Air Core Transformers are not merely "matched," but are actually tuned to a guaranteed precision of 1/3 of 1%—another Victoreen feature.

Range—Clarity—Volume—Selectivity—Ease of Operation



VICTOREEN MANGANIN RHEOSTATS

The only Rheostat with zero temperature coefficient—no matter how warm the unit becomes the resistance remains absolutely constant.
Victoreen Rheostats have double the number of turns of wire used on ordinary Rheostats—that means twice as fine adjustment.
Genuine Manganin wire used in all Victoreen resistances.

Rheostats

No. 2 (2 Ohms)
No. 6 (6 Ohms)
No. 10 (10 Ohms)
No. 20 (20 Ohms)
No. 30 (30 Ohms)
$1.20 EACH

Potentiometers No. 200 (200 ohms) **$1.50**
No. 400 (400 ohms) **$1.50**

Noiseless—Beautiful—Convenient—Single Hole Mounting

Ask Your Dealer for a Free Folder and Hook-up of the Victoreen Set—or Write Directly to Us

THE GEORGE W. WALKER CO.

6540 Carnegie Ave. Cleveland, Ohio

Branch Sales Offices Are Located at

50 Church St., New York City
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300 Sugar Bldg., Denver, Colo.
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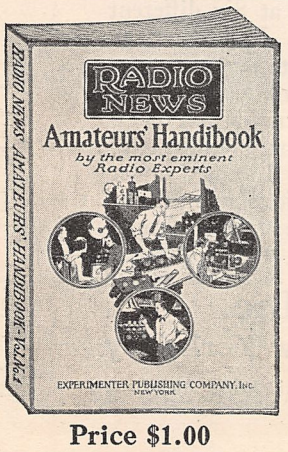
508 So. Dearborn St., Chicago, Ill.
45 Ruggery Bldg., Columbus, Ohio.
443 So. San Pedro St., Los Angeles, Calif.
Box 321, Boise, Idaho.
332 St. Catherine St., W., Montreal, Que., Can.



Price $1.00

JUST THE BOOK YOU WANTED

"Radio News"

AMATEUR'S HANDBOOK

Volume No. 1 (Fourth Printing)

Chock full of radio constructive and instructive articles from cover to cover. Written by foremost radio authorities, in plain everyday language which everyone can understand. Sections include articles on Receiving Sets and Sundry Aparatus, Transmitters and Accessories, Radio Theory, Vacuum Tube Data, and Practical Hints for the Amateur. A book which also serves as a ready reference and should find a place in the library of every amateur. It contains 224 pages and over 375 illustrations, diagrams, and photographs, bound in a multi-colored heavy board. On sale at all leading radio stores. If your dealer cannot supply you, send a dollar bill and the book will be forwarded to you postpaid.

EXPERIMENTER PUBLISHING CO., Inc.
53 Park Place, New York

List Price: $105.00

* * *

Trade Name: Yale-Premier
Circuit: Tuned radio frequency — Navy licensed
Batteries: Either
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Three
List Price: $150.00
Manufacturer:

ZENITH RADIO CORPORATION,
310 S. Michigan Ave., Chicago, Ill.
Trade Name: Super Zenith VII
Circuit: Special Zenith
Batteries: Dry cell or storage
Antenna: Outdoor or ground
Loud Speaker: Separate
Controls: Two
List Price: $240.00

* * *

Trade Name: Super-Zenith VIII
Circuit: Special Zenith
Batteries: Dry cell or storage
Antenna: Outdoor or ground
Loud Speaker: Separate
Controls: Two
List Price: $260.00

* * *

Trade Name: Super-Zenith IX
Circuit: Special Zenith
Batteries: Dry cell and storage
Antenna: Outdoor or ground
Loud Speaker: Built-in
Controls: Two
List Price: $355.00

* * *

Trade Name: Super-Zenith X
Circuit: Special Zenith
Batteries: Dry cell and storage
Antenna: Outdoor or ground
Loud Speaker: Built-in
Controls: Two
List Price: $475.00

* * *

Trade Name: Zenith 3R
Circuit: Non-radiating regenerative
Batteries: Dry cell and storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $275.00

* * *

Trade Name: Zenith 4R
Circuit: Non-radiating regenerative
Batteries: Dry cell and storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $100.00

* * *

Trade Name: Super-Portable
Circuit: Untuned radio frequency
Batteries: Dry cell
Antenna: Outdoor or loop
Loud Speaker: Built-in
Control: One
List Price: $190.00

ADDITIONAL LIST:
Descriptions arriving after close of issue.

Manufacturer: AERIAL ELECTRIC CO., 128-30 W. Kinzie St., Chicago, Ill.
Trade Name: Crystal Mystery
Circuit: Crystal
Batteries: None
Antenna: Outdoor
Controls: One
List Price: $10.00

Manufacturer: AIR-WAY ELECTRIC APPLIANCE CORP., 618 Broadway, Toledo, Ohio
Trade Name: Air-Way Model 61
Circuit: Tuned radio frequency; 4 stages resistance coupled audio amplifier
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $98.50

* * *

Trade Name: Air-Way Model 62
Circuit: Tuned radio frequency; 4 stages resistance-coupled audio amplification
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $136.50

* * *

Trade Name: Air-Way Model 63
Circuit: Tuned radio frequency; 4 stages resistance-coupled audio amplification
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $197.50

* * *

Trade Name: Air-Way Model 61-D
Circuit: Tuned radio frequency; 4 stages resistance-coupled audio amplification
Batteries: Dry Cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $98.50

* * *

Trade Name: Air-Way Model 62-D
Circuit: Tuned radio frequency; 4 stages resistance-coupled audio amplification
Batteries: Dry Cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $137.50

* * *

Trade Name: Air-Way Model 63-D
Circuit: Tuned radio frequency; 4 stages resistance-coupled audio amplification
Batteries: Dry Cell
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $197.50

* * *

Trade Name: Air-Way Model 41
Circuit: Tuned radio frequency; 2 stages transformer - coupled audio amplification
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $49.50

* * *

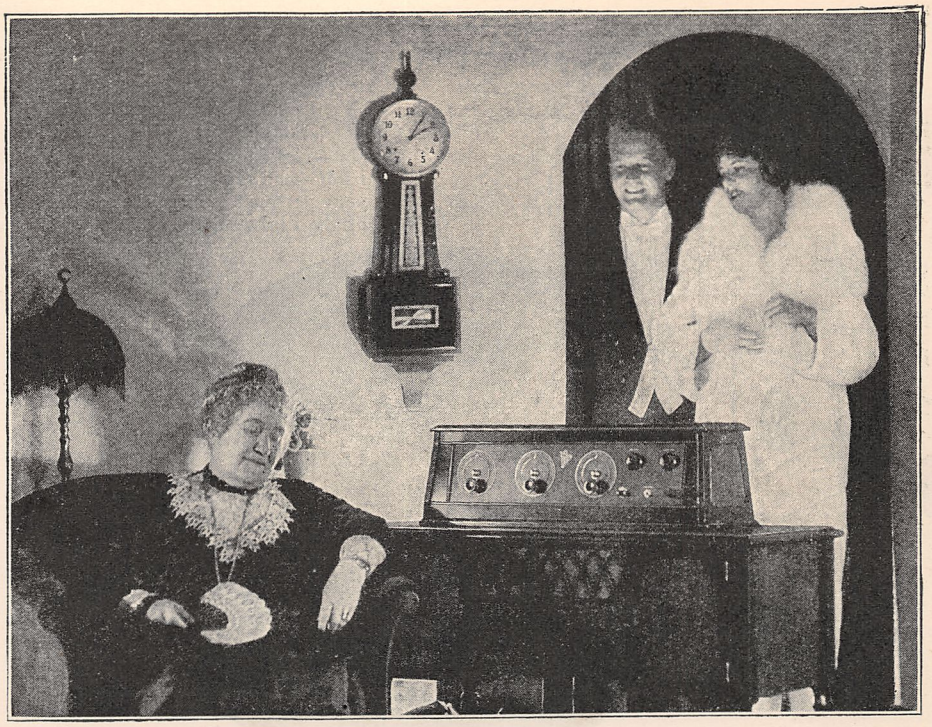
Trade Name: Air-Way Model 51
Circuit: Tuned radio frequency; 2 stages transformer - coupled audio amplification
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $87.50

ALL-AMERICAN RADIO CORP.
2650 Coyne St., Chicago, Ill.
Trade Name: All-Amax Senior
Circuit: Reflex
Batteries: Storage for "A", dry cell for "B"
Antenna: Outdoor
Loud Speaker: Not included
Controls: Two
List Price: $4.00

Manufacturer: AMBER MANUFACTURING CORPORATION, 599 Eleventh Ave., New York City
Trade Name: Marv-O-dyne Model T

Valley Tone

Radio Receiver

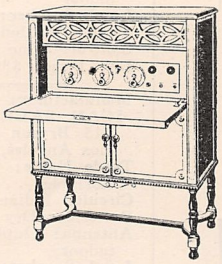


Radio evenings are complete If you have a Valleytone

Appearance

The Valleytone is mounted in a solid walnut cabinet, finished in two tones with inlaid gold stripes. It may also be procured in beautiful console models. Special Valley tables with built-in loud speaker may be obtained for the cabinet model.

Valleytone Console Model



Valley table with built-in loud speaker

You can always count on a full evening's entertainment if you have a Valleytone Radio Receiving Set.

Music with your dinner ' ' ' bedtime stories for the children ' ' ' a play, an opera, or a concert ' ' ' jazz, mammy songs, spirituals ' ' ' the whole range of radio broadcasting can be yours.

With the Valleytone, you can choose your programs by the clock and hear them all the evening through.

For the Valleytone is selective. It will separate and bring in stations only four or five meters apart and will easily separate local and distant stations.

Valleytone selectivity gives a new meaning and puts a new pleasure in radio.

And with the balanced tone of the Valleytone when you hear a station you marvel that any reproducing mechanism can really achieve such faithfulness and such natural results.

The superiority of the Valleytone can be demonstrated. The Valleytone thrives on comparison. Wherever it is judged by results and performance, it wins a new owner.

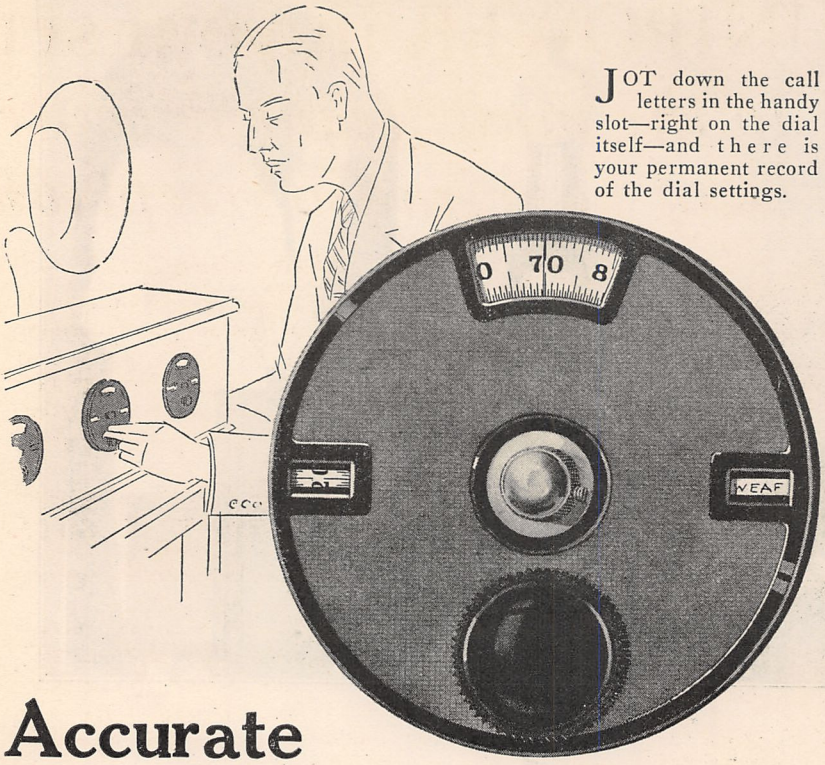
Any authorized dealer will be glad to demonstrate the Valleytone for you.

VALLEY ELECTRIC COMPANY, *Radio Division*, ST. LOUIS, U.S.A.

Branches in Principal Cities

Valleytone Receiving Sets | **Valley Battery Chargers** | **Valley B-Eliminators**

Valley Electric



JOT down the call letters in the handy slot—right on the dial itself—and there is your permanent record of the dial settings.

Accurate Tuning Now Made Easy

This has been the choice: "Selectivity—or—Ease of Control." Heretofore, every set builder, every set owner, every set designer, in order to get one of these qualities, has had to sacrifice *something* of the other.

But now you can have ease of control *and* supremely accurately tuning—have them *both,* and have them with your present set.

The new MAR-CO dial does it! For development in dials has *not,* as many supposed, reached its limit.

This handsome dial—typical of MAR-CO precision—responds to your slightest touch. There is no *suggestion* of backlash. It moves smoothly, evenly, and splits a single degree into hairs'-breadth divisions.

Several noted set manufacturers have already adopted MAR-CO dials. Circuit designers are specifying them.

Put MAR-CO dials on your present set—or on the new set you buy or build. Till then, you can never know what a difference a dial can make.

Nickel Plated $2.50

Gold Plated $3.00

MARTIN-COPELAND COMPANY
Providence, R. I.

MAR-CO RADIO PRODUCTS Vernier Dial

Join the Chase for Extra Dollars!

You can easily replace those dollars which are constantly slipping away from you—*by increasing your income.* Experimenter subscription work offers you this opportunity. Simply sell us a few hours of your spare time each week.

No investment or experience is necessary. All supplies are furnished by us. We teach you and help you in all of your efforts. The coupon below will bring you full particulars about this unusually attractive offer.

——— CLIP OUT—MAIL NOW ———

E. J. FOLEY, EXPERIMENTER PUBLISHING CO.,
Box 105, 53 Park Place, New York City.

Please send me, without obligation, full particulars concerning your money-making plan.

Name .....

Street .....

City ..... *State* .....

Circuit: Two-stage radio frequency
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $90.00

* * *

Trade Name: Marv-O-Dyne Model D
Circuit: Two-stage radio frequency
Batteries: Storage, may be adapted to dry cell
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Two
List Price: $125.00

* * *

Trade Name: Marv-O-Dyne Model DC (Console)
Circuit: Two-stage radio frequency
Batteries: Storage, may be adapted to dry cell
Antenna: Outdoor or indoor
Loud Speaker: Built-in
Controls: Two
List Price: $185.00

Manufacturer: AMERICAN APPARATUS CO., Richmond, Ind.

Trade Name: CN-8
Circuit: Tuned radio frequency
Batteries: Dry cell or storage
Antenna: Outdoor or loop
Loud Speaker: Built-in
Control: One
List Price: $80.00

* * *

Trade Name: AMACO CN-8
Circuit: Amacodyne
Batteries: Dry cell or storage
Antenna: Outdoor and indoor
Loud Speaker: Separate.
Control: One
List Price: $60.00

* * *

Trade Name: AMACO CN-9
Circuit: Amacodyne
Batteries: Dry cell or storage
Antenna: Outdoor and indoor
Loud Speaker: Baldwin Unit built-in
Control: One
List Price: $80.00

Manufacturer: AMERICAN SALES CO., 415 Bryson Bldg., Los Angeles, Calif.

Trade Name: "Indian" Portable
Circuit: Indian
Batteries: Dry cell
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Two
List Price: $14.90

Manufacturer F. A. D. ANDREA, Inc., 1581 Jerome Ave., New York City

Trade Name: FADA "One Sixty"
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor or indoor (outdoor preferred)
Loud Speaker: Separate
Controls: Three
List Price: $60.00

* * *

Trade Name: FADA "Neutro-Junior"
Circuit: Neutrodyne
Batteries: Storage
Antenna: Outdoor or indoor (outdoor preferred)
Loud Speaker: Separate
Controls: Two
List Price: $40.00

* * *

Trade Name: FADA "Neutroceiver"
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (outdoor preferred)
Loud Speaker: Separate
Controls: Three
List Price: $125.00

* * *

Trade Name: FADA "Neutrola"
Circuit: Neutrodyne
Batteries: Storage or dry cell
Antenna: Outdoor or indoor (outdoor preferred)
Loud Speaker: Built-in
Controls: Three
List Price: $175.00

* * *

Trade Name: FADA Neutrodyne Phonograph Panel
Circuit: Neutrodyne
Batteries: Storage or dry cell
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Separate
Controls: Three
List Price: $100.00

* * *

Trade Name: FADA "Neutroceiver Grand"
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Separate
Controls: Three
List Price: $175.00

* * *

Trade Name: FADA "Neutrola Grand"
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Built-in
Controls: Three
List Price: $225.00

* * *

Trade Name: FADA Davenport Table (Console)
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Built-in
Controls: Three
List Price: $225.00

* * *

Trade Name: FADA Queen Ann Desk
Circuit: Neutrodyne
Batteries: Storage or dry cell
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Built-in
Controls: Three
List Price: $300.00

* * *

Trade Name: FADA Console
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Built-in
Controls: Three
List Price: $275.00

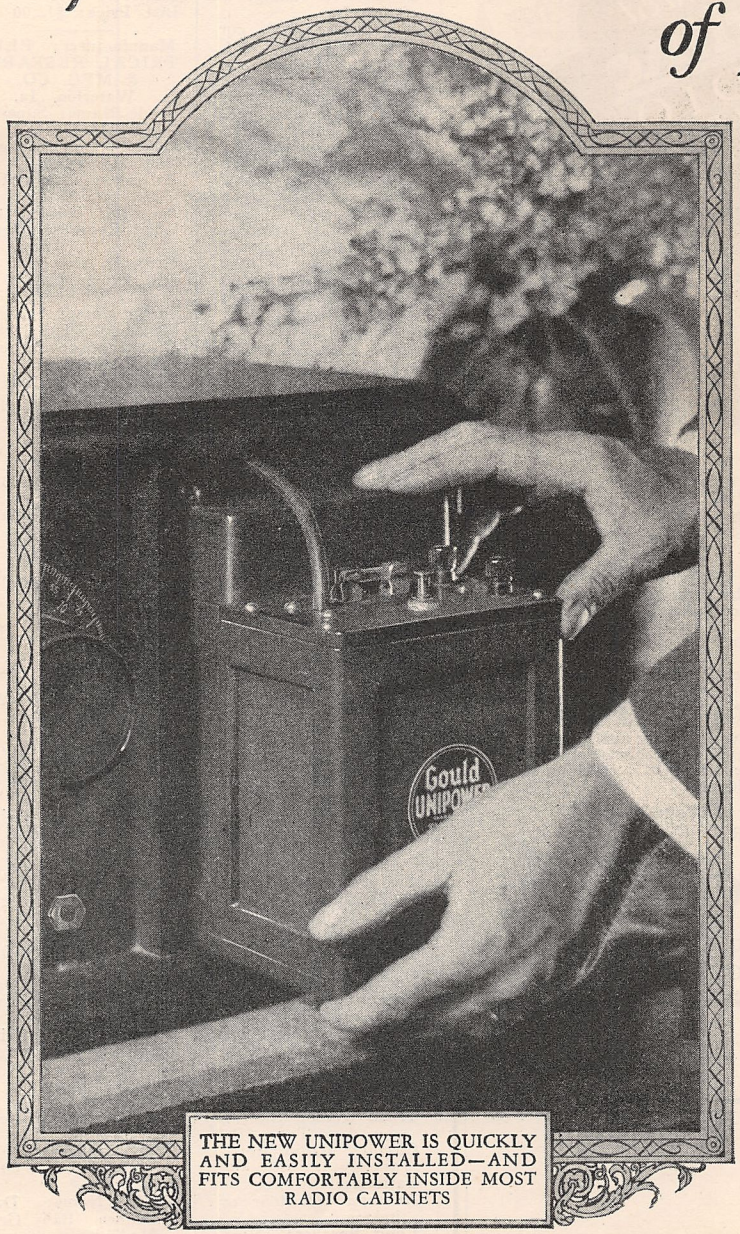
* * *

Trade Name: FADA Beethoven Grande
Circuit: Neutrodyne
Batteries: Dry cell or storage
Antenna: Outdoor or indoor (designed for outdoor)
Loud Speaker: Built-in
Controls: Three
List Price: $250.00

Manufacturer: BATTERYLESS RADIO CORP., 1457 Broadway, New York City

When you put UNIPOWER in your set

~ you put an end to the most frequent cause of poor radio reception



THE NEW UNIPOWER IS QUICKLY AND EASILY INSTALLED—AND FITS COMFORTABLY INSIDE MOST RADIO CABINETS

NO longer is it necessary for you to put up with the inconvenience of operating your set on dry "A" batteries—or the bother of charging a storage battery every week or so! No longer need your "A" batteries fail when you want them most. And that today is the most frequent cause of poor radio reception.

You can now equip your set with Unipower and have the thrill of *continuous, unfailing* "A" power always of the highest quality and refinement, always at full voltage.

What Unipower is

Unipower is a compact, scientifically designed "A" power plant that automatically converts house lighting current into radio power. Unipower is *not* a battery eliminator and should not be confused with any other radio power device.

Unipower comes to you completely wired and assembled—all you have to do is connect two wires to your set and plug in on your house current. Unipower then requires absolutely no attention except the occasional addition of water. Unipower is equipped with an exclusive Balkite charger of special design. Unipower will last you for years, and there are no tubes, bulbs, lamps or working parts that require frequent and expensive replacement.

On when it's off — Off when it's on

A unique feature of Unipower is the master-control switch that governs the operation of your entire set. When the switch is *ON*, Unipower feeds your set rich, quiet power that gives ideal reception, with neither hum nor noise. When the switch is *OFF*, Unipower *automatically* replenishes itself on a low trickle charge and with a minimum consumption of current—a few cents a month.

A new experience for you

Until you use Unipower, you will never know how easily, perfectly and economically your set can be operated. Never again will you go back to dry cells—or bother with a storage battery and charger.

The nearest radio dealer can probably supply you with Unipower—or will be glad to get it for you immediately. The Gould Storage Battery Co., Inc., 250 Park Avenue, New York.

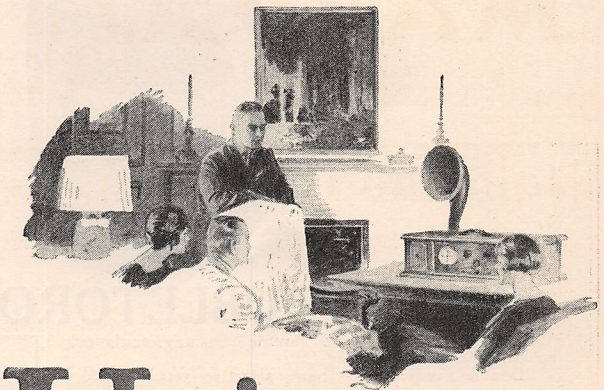
The first cost is the last!

Unipower's first cost is moderate—and the first cost is the last because Unipower has no tubes, bulbs, lamps or working parts that require frequent and expensive replacement. Unipower will last you for years. Compared with dry "A" battery operation, Unipower pays for itself over and over again.

The standard Unipower operates from alternating current, 110-125 volt—60 cycle. The 4 volt type is for sets using UV-199 tubes or equivalent and retails for $35.00. The 6 volt type is for sets using UV-201-A tubes or equivalent and retails for $40.00. West of the Rockies, prices are slightly higher. (Special models, 25-50 cycle are available.)

FREE!

Write for interesting booklet, "Unipower, a triumph in radio power."

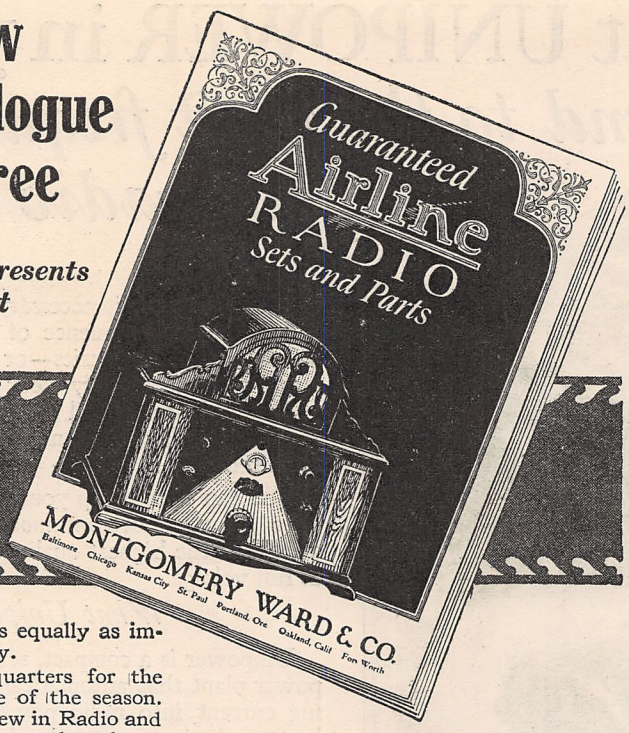


Unipower

Off when it's on ~ On when it's off

Ward's New Radio Catalogue Is Yours Free

This Catalogue represents the world's greatest radio store



Where you buy Radio is equally as important as the set you buy.

Send to Radio Headquarters for the most complete Catalogue of the season. See for yourself what is new in Radio and what has been actually tested and approved.

See for yourself what low prices can be made on Radio when it is sold without the usual "Radio profits."

A Complete Radio Manual

This new 52 page Radio Catalogue shows everything in parts, batteries, cabinets, contains a list of stations, a radio log for recording stations. It shows the best of the new sets. One tube sets that give amazing results. Five tube sets with a single dial to turn. Think of tuning in one station after another by turning a single dial!

Every price quoted means a big saving to you. Everything offered is tested by our own Radio Experts; in fact, the best experts compiled this Catalogue for you.

Write for this free 52 Page Book. It is yours Free.

Our 53 Year Old Policy

For 53 years we have sold only quality merchandise under a Golden Rule Policy. You can rely absolutely upon the quality of everything shown in this Radio Catalogue.

Write to the house nearest you for your free copy of Ward's new Radio Catalogue. Address Dept. 2-R

ESTABLISHED 1872

Montgomery Ward & Co.

The Oldest Mail Order House is Today the Most Progressive

Baltimore Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Ft. Worth

Patented Mar. 31, 1925

THE "DOUBLETOROID" COIL

"Doubletoroids" can be mounted at any angle or spaced at any distance.

"Doubletoroids" make more selective sets possible, since they do not form miniature loop aerials.

"Doubletoroids" hold static and other disturbances to a minimum since no current from an external source can influence them.

Outstanding Features of the Doubletoroids.

Both primary and secondary are true toroids.
The magnetic path is shortest.
It is the most compact.

RADIO FOUNDATION, Inc.
25 West Broadway New York

Patented June 16, 1925

It's Variable

The Nonoise Gridleak improves reception because it can be adjusted for every station. Fits standard brackets. Absolutely noiseless. At all dealers and in the better sets.

NONOISE GRIDLEAK

Trade Name: "No-Bat-Ry"
Circuit: Super-tuned radio frequency
Batteries: Electric current, D.C. or A.C.
Antenna: Outdoor or indoor
Loud Speaker: Separate
Control: 3 tuning, 2 controls
List Price: D.C. current, $140.00; A.C. current, $200.00

* * *

Trade Name: "Bat-Ry-Les" Console Model
Circuit: Super-tuned radio frequency
Batteries: Electric current, D.C. or A.C.
Antenna: Outdoor or indoor
Loud Speaker: Built-in
Control: 3 tuning, 2 controls
List Price: $200.00 (can be used with either D.C. or A.C. current)

Manufacturer: CHAS. A. BRANSTON, Inc., 815 Main St., Buffalo, N. Y.
Trade Name: Branston Hetrola V Cat. No. R45
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Not included
Controls: Two
List Price: $75.00

* * *

Trade Name: Branston Hetrola V Cat. No. R46
Circuit: Tuned radio frequency
Batteries: Storage
Antenna: Outdoor
Loud Speaker: Built-in
Controls: Two
List Price: $120.00

Manufacturer: DIETRICKSON RADIO CO., Inc., 3rd and Elmond Sts., St. Joseph, Mo.,
Trade Name: Dietrickson, Inc. Duo-5
Circuit: Radio frequency
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Two
List Price: $85.00

* * *

Trade Name: Dietrickson, Inc. Type 5R-F
Circuit: Radio frequency
Batteries: Storage
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Two
List Price: $40.00

* * *

Trade Name: Dietrickson, Inc. Type 2R-4
Circuit: Regenerative
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $16.00

* * *

Trade Name: Dietrickson, Inc. Type 2R-3
Circuit: Regenerative
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $12.00

Manufacturer: ELECTRICAL RESEARCH & MFG. CO., Waterloo, Ia.
Trade Name: Superiorflex Model S-3
Circuit: Superiorflex—double reflex
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Control: One
List Price: $100.00

* * *

Trade Name: Superiorflex Model P-3
Circuit: Superiorflex—double reflex
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Separate
Control: One
List Price: $125.00

* * *

Trade Name: Superiorflex Model 419-3
Circuit: Superiorflex—double reflex
Batteries: Dry cell or storage
Antenna: Outdoor
Loud Speaker: Built-in
Control: One
List Price: $250.00

Manufacturer: DAVID GRIMES, Inc., 1571 Broadway New York City
Trade Name: David Grimes "Empire Model"
Circuit: David Grimes Inverse Duplex
Batteries: Dry cell
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $125.00

* * *

Trade Name: David Grimes "Renaissance Model"
Circuit: David Grimes Inverse Duplex
Batteries: Dry cell
Antenna: Outdoor or indoor
Loud Speaker: Separate
Controls: Three
List Price: $125.00

* * *

Trade Name: David Grimes "Baby Grand Model"
Circuit: David Grimes Inverse Duplex
Batteries: Dry cell
Antenna: Outdoor
Loud Speaker: Separate
Controls: Two
List Price: $49.50

* * *

TO BE CONTINUED NEXT MONTH

RAILWAVES

Watter: "Do you think radio can be applied to the railways?"

Wayve: "Why not? Wave trains have been used for years."

Contributed by Jack Bront.

THE WORST IS YET TO COME

Europe is receiving American dance music by radio, and so far has been very decent about it.

Contributed by Frank Kitchell.

Tic: "Do your neighbors know that your radio set is portable?"

Toc: "I guess not. They haven't tried to borrow it yet."

Contributed by Les Van Every.

GOLD SEAL TUBES

One Man Tells Another!

Actual performance has built Gold Seal's popularity

They last twice as long . . . they reach the peak of perfection in reception . . . That consensus of opinion has given Gold Seals the call wherever perfect reception, without excuses, is demanded. We have watched them operate under some of the most exacting test conditions, where other tubes failed. But Gold Seals performed in true Gold Seal style.

Winning national recognition purely on their merits is surely proof of the worth of Gold Seal Tubes. It shows, too, that when radio fans find a superior tube, they're quick to tell others. Nothing else could account for the splendid demand for Gold Seals.

. . *Engineered and Guaranteed* . .

Gold Seal filament is a tube engineering accomplishment destined to revise the radio world's estimate of what fine reception is. And in a splendidly equipped plant, Gold Seal's standards and exhaustive double-tests send each tube out *perfect.*

If you use a tube rejuvenator, Gold Seals will help you get longer tube life. *They can actually be rejuvenated.*

A no-argument guarantee goes with every Gold Seal Tube. Your dealer in giving you this guarantee knows it means what it says because he knows the resources of the Gold Seal organization.

Just say Gold Seal to your dealer. You'll get the tube you have waited for. If your dealer is not yet supplied, write us direct.

Everywhere

$2.50

and Guaranteed

Manufactured in All Types

Facts About Tubes

1—A tube and its guarantee are only as good as the intentions of the organization behind them.
2—Gold Seals are winning on tested merit.
3—Dealers stand back of them because we stand back of the dealers.
4—Gold Seal's engineers are radio experts; the Gold Seal plant is a reality and a model of efficiency.
5—There were six months of exhaustive experiment before Gold Seal Engineers would permit a single tube to be offered to the public.

GOLD SEAL PRODUCTS COMPANY, *Inc.*

250 PARK AVENUE, NEW YORK

A Radio Cabinet of Beauty and Elegance Direct to You at Lowest Cost

Lid splined both ends to prevent warping. Nickeled piano hinge. Nickeled lid support of artistic design. Anti-vibration cushion feet (not visible in cut). Edges of lid moulded to match bottom. Shipped securely packed in strong carton. Prompt shipment.

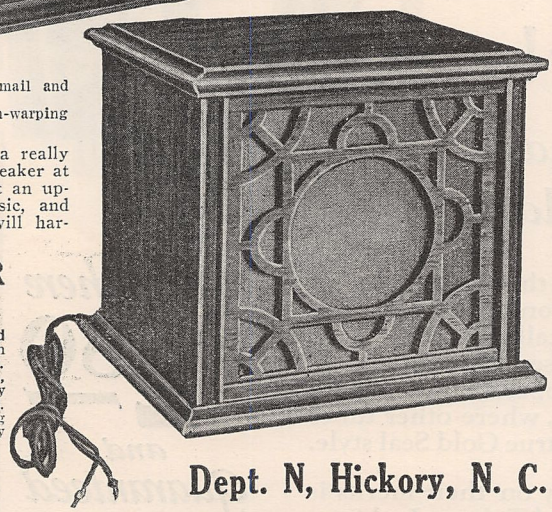
	Hardwood Rubbed Mahogany Finish	Solid Black American Walnut
7x18x7½ or 10 in. deep	$3.50	$5.00
7x21x7½ or 10 in. deep	3.75	5.25
7x24x7½ or 10 in. deep	4.00	5.50
7x26x7½ or 10 in. deep	4.75	6.25
7x28x7½ or 10 in. deep	5.50	7.00
7x30x7½ or 10 in. deep	6.00	8.00

Cash with Order or C.O.D. if ¼ of price is sent with order. Prices F. O. B. Hickory, N. C.

Order express shipment often cheaper than mail and much safer from damage.
Free with Each Cabinet a glued-up stock non-warping ½-inch Baseboard. **Free Catalogue.**

YOU HAVE BEEN WAITING for a really efficient medium sized Cabinet Loud Speaker at a **reasonable** price. But you want first an up-to-date reproducer of speech and music, and then a piece of nice furniture that will harmonize with the finish of your set.

THE IVEY LOUD SPEAKER IS ALL OF THAT



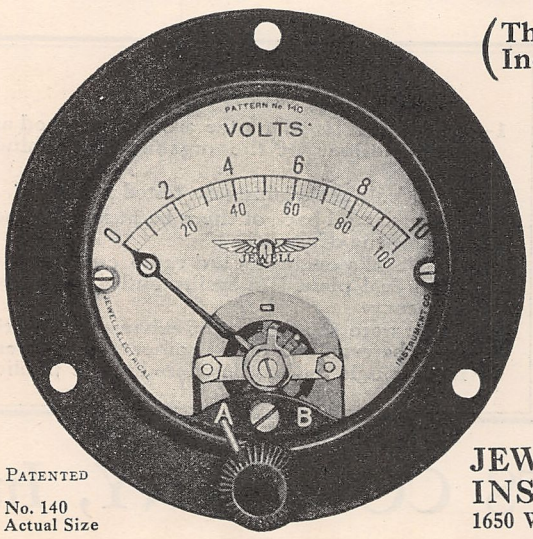
SPECIFICATIONS.—A powerful **high-pitched** telephone Unit that has just been perfected in the laboratory. A Horn developed by experts. A highly finished Cabinet of pleasing design, size 8x9½x8¼. Your choice of rich mahogany finish or solid walnut. Price $15.00 F. O. B. Hickory. Cash with order. Shipped in a strong WOODEN BOX, with 5-foot cord all ready to use.

SOUTHERN TOY CO., Dept. N, Hickory, N. C.

JEWELL

"2 in 1"—

(The Case Is Only 2 Inches in Diameter)



¶ The self contained switch permits the reading of filament and "B" battery voltages.

¶ Jewell instruments lead in radio. They are used by broadcasting stations and leading radio engineers all over the world.

¶ Ask your dealer for a Jewell 15-B radio catalog.

PATENTED
No. 140
Actual Size

JEWELL ELECTRICAL INSTRUMENT CO.
1650 Walnut St. : Chicago

26 Years Making Good Instruments

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

A Crack 40-80 Meter Set

(*Continued from page* 605)

pierced with an ordinary steel drill which had first been tempered in mercury.

A word as to the operation of this transmitter might well be added here. In the first place, the antenna was so constructed as to have a fundamental wave-length of 120 meters. The dimensions are here given as a guide in building one to operate in a similar way.

THE ANTENNA

A three-foot cage is suspended at a height of 55 feet and a lead-in 25 feet in length, of 8-inch cage, is brought down to the insulating panel in the window. The total length is 75 feet from the apparatus. The counterpoise is a simple two-wire fan. The wires are separated at the point where the lead is connected at a 30 degree angle. The overall length is 80 feet and the fan is stretched 15 feet from the earth.

Now, with the antenna circuit disconnected from the inductance, the closed circuit may be readily tuned to a wave of 40 meters. The method of tuning will be described shortly. After this is done, connecting the antenna directly to the inductance will cause oscillations to occur on the third harmonic of the antenna fundamental; the resonance point will be indicated by maximum current registered on the antenna ammeter. This has proven a very effective method of operation.

For the 80-meter band the series condenser is inserted, and the natural frequency of the open circuit made to correspond to 80 meters. The closed circuit is brought to resonance by increasing the inductance in the plate and grid circuits, and tuning as a final adjustment with the plate condenser to maximum output.

THE RECEIVER

Here again "simplicity is the best policy." The circuit which has given the best results covers the wave bands from 10 to 125 meters. The coils are wound in an hexagonal form and made self-supporting by small strips of gummed tape. The winding form may be made by inserting pegs or spikes in a small board. After the wire is wound and the winding made secure, the pegs may be removed to facilitate freeing the coil from the form.

The method of mounting the coils is of particular interest. Two hard rubber strips were erected near the back of the baseboard. Two holes, an inch from the top, carry a glass rod from which the coils are suspended. Corresponding to this and directly below it is a copper tube. This tube is grounded, and then all points in the circuit which should be at ground potential are connected to it. The frame of the variable condenser also forms a part of this ground system.

The tuning parts are placed at the back of the board to avoid all capacity effects, and also to eliminate proximity to panels and other wiring. A small "dummy" panel is mounted at the front, and the two dials which it holds are connected to the secondary condenser and the tickler coil by means of glass rods. The latter is bound to the rod with a pair of rubber bands.

In all other particulars, the cut is self-explanatory. Fanned condenser plates, baseless tube (detector) and the one stage of audio frequency amplification are familiar details. It has been found possible, by inserting a small solder lug on the third, seventh, thirteenth and seventeenth (last) turns, to effectively cover all waves from 10 to 125 meters. The antenna coupling coil is of five and the tickler of eleven turns.

The New MURDOCK NEUTRODYNE RECEIVER

NOW—*Shielded*

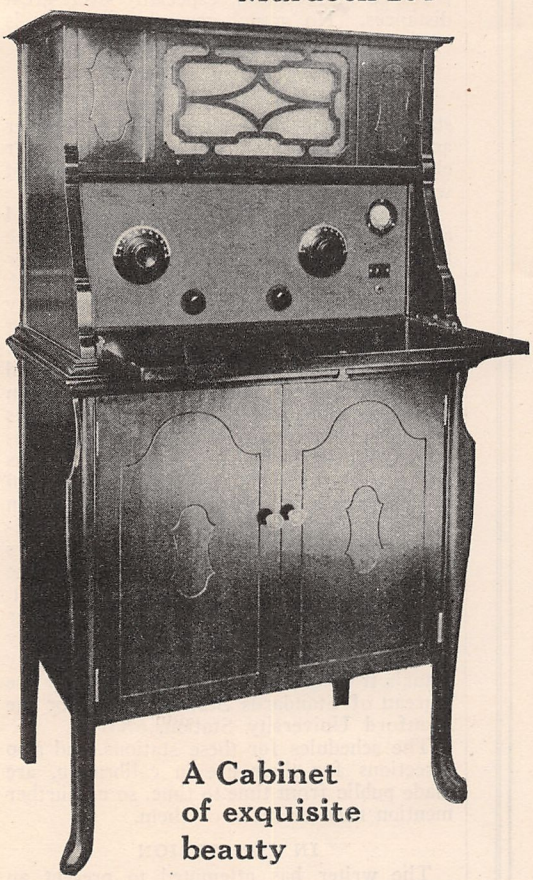
More power—greater sensitivity.

These are the outstanding features of this marvelous receiver.

It embodies the newest achievement in neutrodyne construction—the shield.

You'll be amazed at the way it singles out stations—sifts and separates those you don't want to hear.

Murdock 204



A Cabinet of exquisite beauty

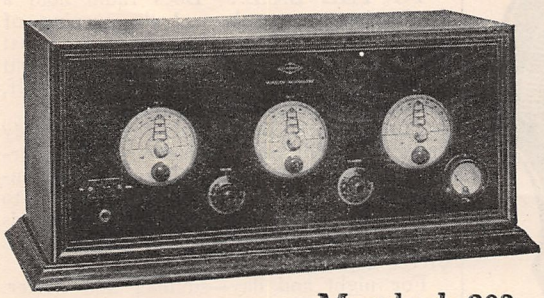
LICENSED BY INDEPENDENT RADIO MANUFACTURERS, INC. NEUTRODYNE REG. U.S. PAT. OFF. REG. U.S. PAT. OFF. PAT. MARCH 27, 1923 AND APRIL 1, 1924 HAZELTINE PATS. NOS. 1,450,080 AND 1,489,228 OTHER PATENTS PENDING

Murdock 200

Five-tube neutrodyne with loud speaker and vernier dials. Embodies now improvements that will be extolled by others in 1926. We also offer Murdock 201—the same instrument without loud speaker.

There are opportunities for eager, energetic, enthusiastic merchandisers to become Murdock dealers. Write for information. Every day counts just now. Mail your letter tonight.

Wm. J. Murdock Co.
DEPT. 92
Chelsea, Mass.

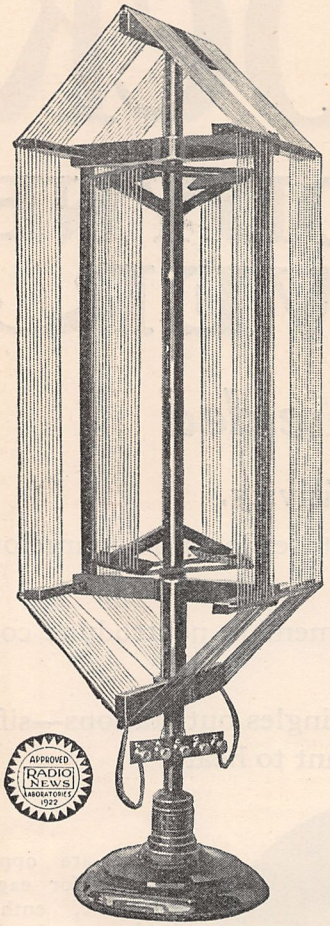


Murdock 203

Six-tube neutrodyne. Remarkable selectivity and simplicity in tuning make this a truly fine receiver.

MURDOCK RADIO

Standard since 1904



Like Red Grange Dodging Tacklers so AERO-LOOP

eludes near-by stations, straight-arms static, and scores against the far-distant stations that put such a kick into radio reception.

Line up for the 1926 season with Aero-Loop as an essential part of your equipment.

"A Loop Within a Loop", with the inner loop stationary and acting as a "booster" while the outer loop is ajusted by rotating—

Can be used with—or to replace—outside antennae.

Sells for $12.50. Ask your dealer. Shipped direct on receipt of price, express paid, if not at your dealer's. Be sure to specify the set with which it is to be used. Please give dealer's name.

Write for 12-page Descriptive Diagramatic Aero-Loop Booklet. Your copy Free.

$12.50

Beautifully finished in mahogany. Dimensions 30 in. x 8 x 7 in.

SCOTT SALES COMPANY
National Distributors
443 SOUTH SAN PEDRO STREET
LOS ANGELES, CALIFORNIA

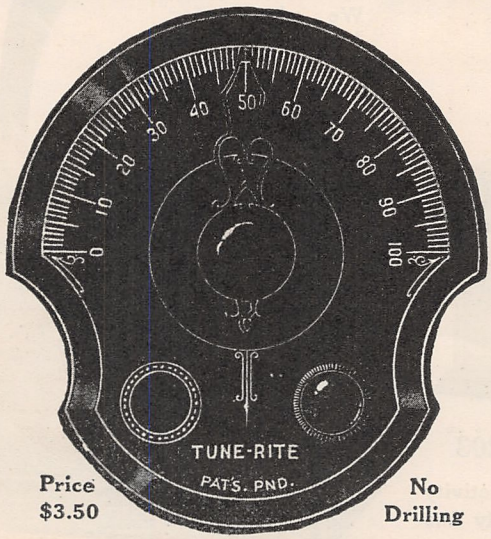
UTT-WILLIAMS ELECTRICAL PRODUCTS CO.
SANTA ANA, CALIFORNIA

Separates Those Crowded Stations

No matter how crowded the low wave stations, they are easy to get, clear, perfect in tone. All accomplished with this beautiful dial. So scientifically thought out that it's really a revelation in tuning. Gives your present set every advantage of the **straight line frequency** receiver, but without the necessity and expense of rewiring. Gradually changing ratios from 24 to 1 at low wave lengths to 2 2/3 to 1 at high wave lengths does the trick. **Instantly attached to any set.**

Convert your set to straight line frequency. Send for instructions.

RADIALL COMPANY
Dept. T.R.N.-1, 50 Franklin St., New York



Price $3.50

No Drilling

TUNE-RITE

The Straight Line Frequency Dial

Made by the makers of Amperite, the Self-Adjusting Rheostat

All are wound with No. 16 D.C.C. wire.

Several receiving antenna systems have been tried at the writer's station. It is interesting to note that the one which has proven the most satisfactory under all conditions is that employing a single wire about 40 feet long, and stretched across the room as an antenna and another outside, 20 feet high, which acts as a counterpoise. This combination has been found to give the greatest signal-static ratio, which is of great importance in reception, especially over great distances. No actual ground connection is used, as the counterpoise takes its place.

THE WAVE METER

A wave meter is a first essential in any station, both in connection with the receiver and the transmitter. There is no need for elaborate equipment in this line, the simplest will satisfy just as well.

A variable condenser with a coil shunted across its terminals can be used to measure the frequency of a receiver or transmitter by what is known as the "click" method. This method owes its existence to the ability of a circuit in resonance with an oscillating circuit to absorb a certain amount of energy.

In the receiver this resonance is indicated by a click on the phones as the absorption of energy momentarily stops the oscillations in the secondary circuit. When the transmitter is being tested, the absorption causes an increase of the plate current, accompanied by a decrease in the antenna current when the two circuits are "in tune." The maximum change indicated by either one occurs at the exact resonance point, and hence the wave may be read from the calibration chart.

It is not difficult to calibrate a wave meter to a comparatively high degree of accuracy by making use of the standard frequency signals transmitted from time to time by the Bureau of Standards Station WWV, or the Stanford University Station, 6XBM.

The schedules for these stations, and also directions for their use in calibration, are made public from time to time, so no further mention need be made of them.

IN CONCLUSION

The writer has attempted to present an accurate description which will be of value to the entire radio public. Its significance is increased by the probability that within the next few months, the 150-200 meter band will be given over to broadcast stations. This leaves only the lower bands open to amateur transmitters, and it is hoped that this presentation will interest both those who are entering the field for the first time, and those whose experience has been gained on the higher band.

TO THE B.C.L.: Does radio hold a fascination to you beyond the turning of dials, and the voice of the distant broadcast announcer? Haven't you often wished that you could answer back—that you, yourself, could talk to other fans miles away?

TO THE AMATEUR: You already know the thrill which comes from conquering distance with a set of your own construction. The field of "40-80" opens to you even greater possibilities. These bands might well be called the "all-round" bands of the amateur family.

For night and day—summer and winter, a station which can operate on these two waves, and can shift easily from one to the other as is true of the one here described, will be able at all times to cover the greatest distance and maintain the most consistent communication.

ANESTHESIA

Friend: "What a horrible noise comes out of your radio, Jack."

Jack: "Well, if you were just coming out of ether, you'd make a horrible noise, too."

Contributed by Vernor F. Aspinwall.

Day-Fan
Took "the Needle in the Haystack" out of Radio

A MAN in California looked in the San Francisco Examiner.

A woman in Texas looked in the Houston Chronicle.

A boy in Maine looked in the Portland Express.

All three papers said "Opera tonight from Chicago Station WGN—wave length 370 meters."

In their three corners of the continent, all three radio listeners turned the dials of their Day-Fan Radios to 370, and there was the opera.

When any Day-Fan Radio in any state can dial a newspaper number and get that station, "the needle in the haystack" searching is gone from radio for good. If the station you want isn't in the newspaper, its number is in the Day-Fan Air Telephone Directory.

Day-Fan is the Super Radio, because it is super-accurate.

Day-Fan is the Super Radio because it is super-simple. Look, turn, listen.

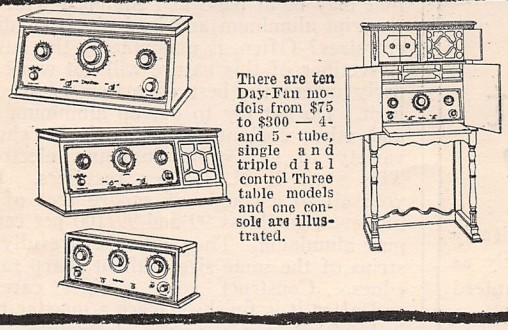
Day-Fan is the Super Radio because it is super-selective—getting the station you want instead of the station that wants you.

And finally, Day-Fan is the Super Radio because it is super-toned—the most important point of all—sweet and true as a bell in the treble of the flute, sturdy and clear-cut and strong in the organ base—wider in its musical range than any other instrument—the very voice of the speaker, or the note of the violin—the musical instrument of radios.

Any Day-Fan dealer will enjoy showing you the ten Day-Fan models, four and five-tube, table or console, triple or single dial control, from $75.00 to $300.00. You owe it to yourself to own a Day-Fan.

The Dayton Fan & Motor Co., Dayton, O.

For more than 36 Years Manufacturers of High Grade Electrical Apparatus



There are ten Day-Fan models from $75 to $300 — 4- and 5-tube, single and triple dial control Three table models and one console are illustrated.

Day-Fan
RADIO

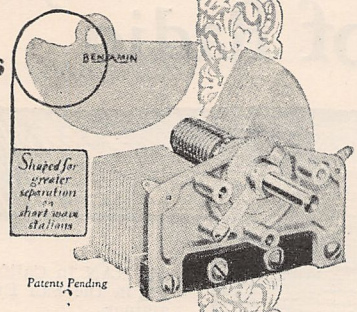
Perfect Results

in Radio Reception

In reproducing the bewitching melody of some famous orchestra, all working parts in the radio set must co-ordinate and harmonize with each other to develop perfect reception. Individually or in combination, Benjamin Super Radio Parts achieve this beautiful tonal perfection by banishing disturbances and distortions, stopping radio losses, properly balancing the tuning range, increasing selectivity, and in making the set neater and better looking.

These unusual advantages increase radio enjoyment. Benjamin Super Radio Parts have become the standard for Perfect Results—just as they have become the standard equipment in many of the finest, factory-made radio sets found in the homes of true music lovers.

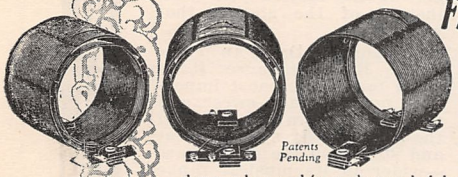
Benjamin Low Loss Long Range Condensers



Straight line type. Spreads the broadcast range on the lower wave lengths, eliminating bunching of stations on the lower side of the dial. The cut-away shape of the rotor blades aids sharp tuning and makes tuning much easier. Minimum insulation is used and leakage must go through long paths outside of strongest field. Unpolished silver plate finish. Small size of condenser makes it adaptable to any set, regardless of crowding of apparatus on subpanel. Friction disc on rotor shaft adjusts turning tension without throwing rotor plates out of alignment. Drilling template furnished with each condenser. Made in three sizes: 13 plate for .00025 Mfd., 17 plate for .00035 Mfd., and 25 plate for .0005 Mfd.

Patents Pending

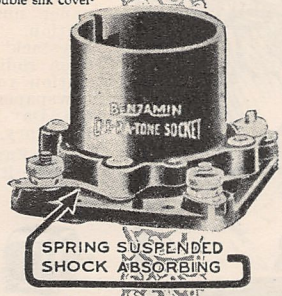
Benjamin Tuned Radio Frequency Transformers



Patents Pending

Low Resistance. Low Distributed Capacity. Wires are space wound, adjacent coils are parallel, air insulated and so separated that while capacity is reduced to a minimum, inductance is maintained at a high point of efficiency. Makes any set more selective by enlarging the tuning range. The coils are very uniform, both in inductance and distributed capacity, so that if desired, they may be geared for single control of the tuned stages. A minimum amount of material is used in the field of the coil, and an anti-capacity cement is used only where the wires cross. Coils are coupled so as to reduce capacity of coupling to a minimum. Green double silk covering provides high insulation and gives a fine appearance to the coil.

Benjamin Cle-Ra-Tone Sockets



Benjamin Cle-Ra-Tone Sockets prevent the transmission of outside vibrations into microphonic disturbances. Four delicately adjusted double springs support the socket—"float" it above the base—and absorb all jars and shocks. An absolute necessity in portable sets. Used by leading manufacturers and recommended by radio engineers in the most popular hook ups. There are no rubber parts to deteriorate. Bakelite is used wherever possible to insure sturdiness, long life and high insulation. Handy lugs make soldering easy. Stiff bus wiring does not affect the flexibility of the Cle-Ra-Tone Springs. Furnished also in gangs on Bakelite sub-panels for compact set building, as when mounted on Benjamin brackets there is plenty of space underneath for mounting accessory equipment.

Patented July 28, 1925 May 2, 1911

Benjamin Electric Mfg. Co.

247 W. 17th Street New York | 120-128 So. Sangamon Street Chicago | 448 Bryant Street San Francisco

Manufactured in Canada by the Benjamin Electric Mfg. Co. of Canada, Ltd., Toronto, Ontario

DELTA

"There is no better Headset at any Price"

Supersensitive, loud and clear. Reproduces clearly and naturally. Electrically and mechanically as perfect as the highest priced headset. Guaranteed equal in performance to any or all other makes. Tested and tone-matched to the utmost precision. DELTAS are BEST sellers because they are *best* made and *best* priced.

Write or wire NOW for full particulars and dealer discounts.

No. 500 2100 OHM $5.50 **No. 501 3200 OHM $6.00**

DELTA ELECTRIC COMPANY, 150 Delta Block, Marion, Indiana, U. S. A.

Standard Makers of Radio Headsets, Electric Lanterns, Auto Spotlights, Auto Ash Receivers, Motorcycle Spotlights, Bicycle Spotlights, Electric Bicycle Lamps, Flashlights and Flashlight Batteries.

Why Run a Junk Shop?

(Continued from page 627)

is the most expensive? You will save money by using this wire because you will protect your instruments.

Another feature of the junk-shop method of running a station is that you never know from one day to the next whether or not the set is going to work as it did the last time you used it. A slight jar may cause one of the inductances to fall out of position a little and thus the whole circuit may be thrown out of resonance. Then you must spend a few hours more getting it back into working shape. If an inductance falls against a tube with a particularly hard jolt—good-bye, tube. If the leads are not fastened carefully to the inductance turns, one or more of them may work out of place and fall off. In this way again, your cherished adjustment will be lost and has to be found all over again.

Now think of the losses that are found when slipshod wiring is carried out. Poor connections and fine wire are things to be despised by the ham who really wants to get results. A few soldered connections, as compared with twisted connections, may mean working that distant station that you have never quite been able to reach.

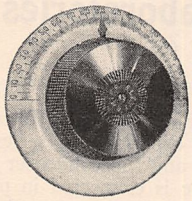
If you pay some attention to the layout of the various parts you will again help yourself. If, for instance, you have part of your audio frequency circuit close to some part of the radio frequency circuit, the results may be affected. If your A. C. line interacts with part of your radio frequency circuit, your transmitted C. W. note will not be as pure as it would be if you kept the two circuits separated. The writer at one time mounted his primary rheostat close to the C. W. inductance. It was found almost impossible to clear up the note so that a pure D. C. tone could be obtained, regardless of the fact that a husky brute-force filter was used. A survey of the set soon pointed toward the placement of the primary rheostat and when that was removed from its proximity to the R. F. circuits, no trouble was experienced in tuning the set to the desired point. Does not this show that study of your set will help you out and that correct placement of apparatus is of advantage?

Probably one of the places where this junk-shop business shows up the most in some ham stations is where a chemical rectifier is used. How often have you seen one of these important parts of a transmitter made up of any number of odd-sized jars that may be at hand and equipped with nondescript aluminum and lead plates of different sizes? Often, is undoubtedly the answer. A rectifier of this nature will not work properly unless the best of materials are used in it. Do not try to cut up aluminum pans and other cooking utensils of the cheaper variety to get your aluminum electrodes. This stuff is N. G. for rectifiers. Blow yourself to a couple of square feet of real honest-to-goodness 99 and 99/100 per cent of pure aluminum. Then cut this carefully into strips of the same size without sharp ragged edges. Construct your rectifier carefully and after it is finished, place a quarter of an inch of oil on top of the electrolyte. Now cover the entire unit with a box, letting the leads run out through holes drilled in the box and forget it for six months. Orderliness in various things will enable you to do just that, forget certain parts of the set for a good long time. Some fellows seem to like to play around with their sets all the time, even when they are working perfectly, but usually they only succeed in making things worse. There is no percentage in that and if you want to do some real ham trans-

Make Radio *DO* What You *Hoped* it Might Do

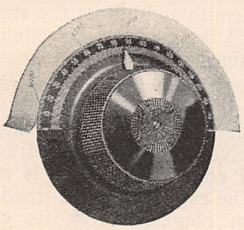
With every piece of Walbert apparatus you take another great step toward realizing your highest radio expectations. Walbert apparatus is specifically created to erase the deficiencies which may now be baffling you. And just from a description of the action of each Walbert appliance you can see how even the finest present-day radio must benefit from these products.

The Dial that changes old Condensers to S. L. F.



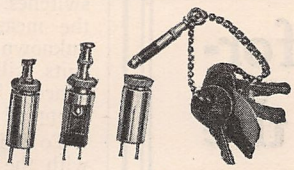
Straight Line Frequency in Condensers has swept Radio. But you can be up-to-date without discarding old condensers. Any semi-circular plate condensers give you perfect S. L. F. characteristics when equipped with Walbert S. L. F. Vernier Dials. You revolve knob and pointer uniformly—Walbert mechanism automatically proportions capacity to broadcast frequencies! No more crowding at low wave lengths. All the famous original Walbert vernier features incorporated in this remarkable S. L. F. dial. **$2.00**

Univernier—to put EVERY station on your log



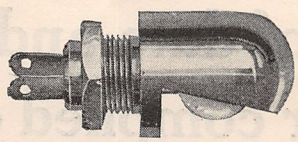
Slows down your slowest finger-twist twelve times! The ideal ratio—12 to 1. Remember the knob diameter is part of the ratio. Big, centered, Univernier knob preserves the ratio. Picks out stations you now miss. Sharpens stations that now blur. Precise gear clearance prevents jumpy starts or stops. Slippage impossible. No effect on condenser bearings. Simplest mounting. Walbert made it first. It still is first by far. New, convenient, removable logging records alone are invaluable. Free with each Univernier. **$1.50**

Make your set *YOURS*



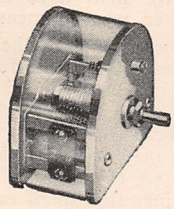
Sure, simple Walbert Lockswitch prevents tampering. No key nuisance. No chance of shock. Phosphor bronze lifetime springs. Standard mounting — easily replaces present switch and makes your set private..... **50c**

Panelite your Set



There is light where your set is, with Panelite. Clear, soft light right on the dials without danger of the house circuit hum. Easily wired. Tiniest current use. Can also serve as a pilot to warn when set is on..... **$1.00** Gold plated **$1.25**

S. L. F. Where You Want It—*COMPACTLY*



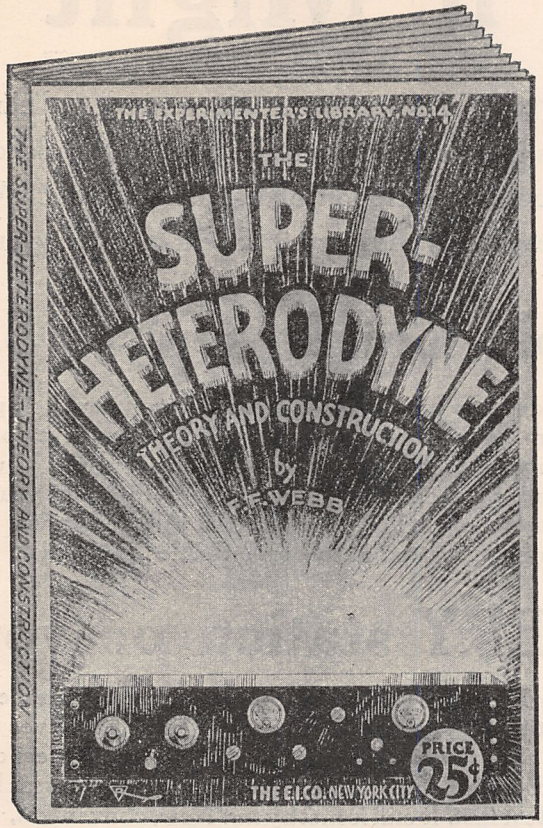
A full inch shorter at least, the Walbert S. L. F. Condenser nevertheless covers the important 90% of the broadcast range with true, straight line frequency characteristics. You really need only that first 90%—so the extra inch of space is worth more than anything else. It is the most practical all-around application of S. L. F. In dust-tight case, with lifetime bearings, spring brass plates, and other highly developed features, Walbert S. L. F. Condenser is priced at only **$3.50** With Univernier control..... **$5.00**

WALBERT

WALBERT made it first.

Manufacturing Company, 923 Wrightwood Avenue, Chicago

The SUPER-HETERODYNE



Here's the finest, most complete book of data and information ever compiled on the Standard Super-Heterodyne.

This is the big book of instruction and information on the various standard "supers" in common use today; a complete, up-to-the-minute, impartial 64-page book covering all the builder or user of this type of set might want to know. The Super-Heterodyne is written by a radio authority who not only has years of trade and practical experience but is constantly designing modern radio apparatus. It is a handy, useful size, 5½ x 7½ inches, printed clearly, profusely illustrated, easy to read and bound with a handsome two-color cover. This is the very latest of the complete library of Experimenters' Handbooks on radio. These books are complete practical guides to almost every important phase of radio transmission and reception.

You can get any of these books at your radio or news dealer or direct from us.

The CONSRAD COMPANY

Sole distributors for the E. I. COMPANY

233 Fulton St. New York, N. Y.

mission, get your set working right and leave it that way.

You may say, and it may be true, that you are obtaining good results with your transmitter, even though you have not made a finished job of the installation. But just stop to think a moment and consider whether or not you would get better results if you cleaned up the apparatus, laid it out systematically and wired it up neatly. I am willing to bet my 50-watter against a pint of vacuum that you would. Try it and see, fellows—it pays.

And the moral of all this? Maybe you won't need a moral by this time, but anyway here goes. If you would have good transmission, eliminate the junk-shop method. Plan things before you actually work them out and lay out your transmitter carefully and wire it up so that you can at least breathe near the set without knocking it out of adjustment.

Activities of the Radio News Laboratories

(*Continued from page* 626)

calibrated condenser, which we will call the standard, is shown connected in series with the coil and meter, and the condenser which we want to measure is connected in parallel with it, and in series with a switch, as shown.

The method of making the measurement is simple. Set the oscillator going at any convenient wave-length and adjust the standard condenser until the greatest deflection of the meter is obtained.

It is evident that the measuring (or pick-up) circuit is then in resonance with or "in tune" with the driver circuit. The wave-length of the driver must be so adjusted that the standard condenser setting is near the maximum. The capacity of the standard condenser is then obtained from its calibration curve.

When this has been done, close the switches. By doing this we are adding to the measuring circuit the capacity of the unknown condenser, and therefore the circuits will, of course, be no longer in resonance. This will be made evident by the dropping of the needle of the meter.

To bring the circuit back into resonance with the driver without changing the wave-length of the driver, we decrease the capacity of the standard condenser until we have the two circuits in resonance again. Obviously, we have had to decrease the capacity of the standard by an amount equal to the capacity of the unknown. If we again obtain the capacity of the standard from the calibration curve and subtract this from our previous value, we shall have the capacity of the condenser we are measuring.

In making these measurements the leads to the unknown condenser do not affect the precision of the measurement, especially if the switch is placed close to the unknown condenser. This is because the slight capacity which these leads may have is added in both cases, and when we take the difference between the two readings this small capacity drops out. Thus, if C_1 is the first capacity reading of the standard, C_2 the second, and c the small capacity of the leads, then the capacity of the unknown is

$$(C_1 + c) - (C_2 + c),$$

and it will be noted that the small capacity c drops out. The leads may, however, have a slight inductance, and for this reason it is well to keep them as short as possible.

In the photograph of the measuring circuit shown herewith, a precision condenser

A Real Long Range Crosley Receiving Set, $9.75 . . . .

Do not assume from its very interesting price that this very unusual Crosley set is a toy. Its impressive performance alone entitles it to serious consideration.

Heretofore, the $10 radio was designed only for local reception. Now the Crosley Pup extends the entertainment radius to 1500 miles under ordinary conditions. Place it beside some costly multiple-tube set and operate the dials. Both tune through local stations sharply. Both get the same programs with equal ease and clarity. Both let you tap the infinite enjoyment coming through the air. There is only one difference—the Pup operates with head phones instead of a loud speaker.

The Pup is the newest Crosley set with a price that reflects the volume-production economies of the world's largest builder of radios. It is substantially constructed and permanent in every regard. Its design is an improvement of the famous Crosley one tube set with which Leonard Weeks of Minot, N. D., heard the MacMillan Polar Expedition while the rest of America listened in vain.

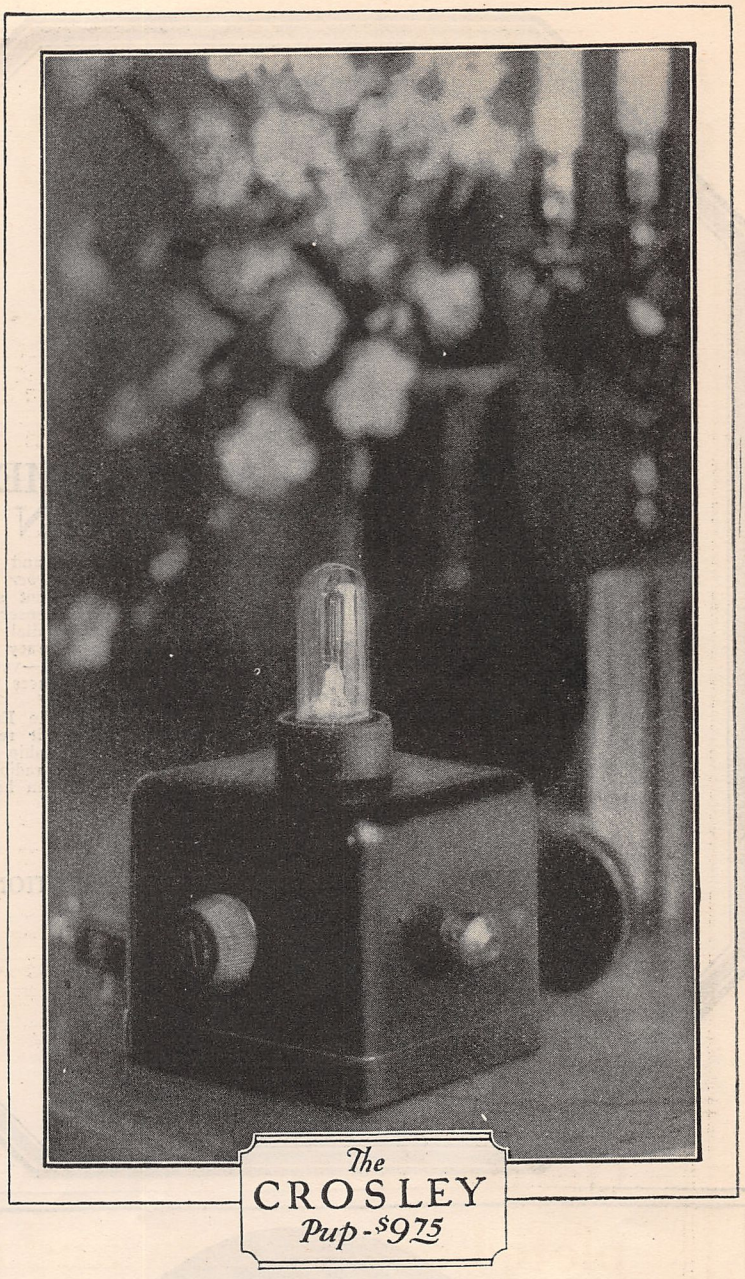
Almost overnight the Pup has become the most popular Crosley set ever offered. It is being bought for youngsters whose curious fingers cannot resist the lure of dials and switches; for the cook, the maid, the old folks back home, and for shut-ins. Traveling men are selecting it because of its easy portability, and radio enthusiasts to have an inexpensive check on their larger sets. Hear it once—and you will own one too!

In addition to the Pup, there is a Crosley for every price and preference. Operating 1, 2 and 3 tubes, these are encased in handsome Crosley-built cabinets and range in price up to the Super-Trirdyn Special which retails for $60. Each will deliver the superlative performance that has made the word "Crosley" a hall mark of radio perfection in millions of homes throughout the world.

THE CROSLEY RADIO CORPORATION

CINCINNATI, OHIO

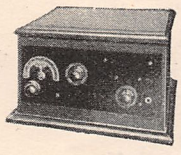
Owning and operating W L W, first remote control super-power broadcasting station



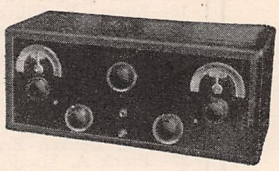
Crosley manufactures receiving sets which are licensed under Armstrong, U. S. patent No. 1,113,149 and priced from $9.75 to $60.00 without accessories. None of the prices quoted include batteries, tubes, headphones, etc. Add 10% to all prices west of the Rocky Mountains.

Crosley De Luxe Combination

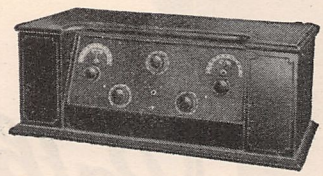
Musicone De Luxe - $27.50
Super-Trirdyn Special - 60.00
Console Table - - - 25.00
Complete - - - - 112.50



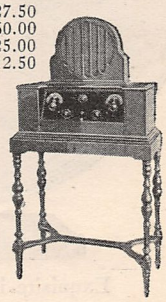
Crosley 3 Tube
52 S. D.
Mahogany finished cabinet, sloping panel. Holds all batteries.
$32.50.

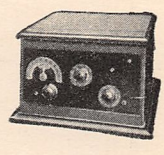


Crosley Super-Trirdyn Regular
More compact than the Special Model—but exactly the same superb performance - -$50.00



Crosley Super-Trirdyn Special
Matchless performance and exquisite beauty combined. Solid mahogany cabinet with popular sloping panel $60.00

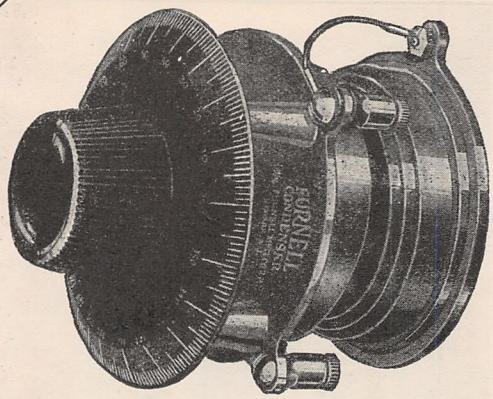




Crosley 2 Tube
51 S. D.
A true long range set, easy to tune and handsome in appearance.
$23.50.

CROSLEY·RADIO

BETTER · COSTS LESS



A REMARKABLE ACHIEVEMENT IN CONDENSER DESIGN

AFTER two years of scientific research by one of America's leading experts in condenser engineering, old standards in design have been swept away by a new and advanced principle.

Never before in radio history has a more valuable and important condenser achievement been offered. No plates, gears or racks to get out of alignment. No solder. No washers. Nothing to become loosened or to get out of order.

Through its unique design, the Furnell 360° Taper Coil Condenser eliminates the confused crowding of so many stations in the lower half of the dial. As a result the set owner hears—clearly and sharply—stations which *he could never hear before* because of lack of efficient selectivity in the ordinary type of condenser.

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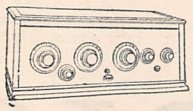

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appears. With this condenser the measurements may be made as close as one micromicrofarad, which is close enough for most practical purposes in radio. The bridge method alluded to above will give values correct to one-hundredth of a micromicrofarad.

The radio fan may, by this time, begin to wonder where he can get hold of a calibrated condenser. Precision instruments cost a lot of money. He can, however, if he wants to make these measurements merely as a guide in choosing condensers, or merely to experiment with the method, calibrate his own condenser by the following method:

Let him use any good variable air condenser having semi-circular plates (which he probably already has) for his standard. He can obtain, either from the advertisements, or by writing to the manufacturer of the condenser, the maximum and minimum capacities of this condenser. Mark these two values on cross-section paper, as shown in Fig. 2, at the points "a" and "b." From the point "b" draw a straight line to the point "d," which indicates a dial setting of about 15. Then, from the point "a" draw a line which gradually rounds off and meets the straight line, becoming tangent to the latter at a dial setting of about 20. The line "bea" will then be a very approximate calibration curve of the condenser, and, along the straight portion of the curve (from "b" to "e") will, in many cases, be "off" not more than about 20 micromicrofarads. The true calibration curve of the condenser is shown by the broken line in Fig. 3.

In making the measurements, the experimenter must be careful not to have too close coupling between the driver and the measuring circuit. If the coupling is too close, there will be reaction, or the measuring circuit will absorb so much energy from the driver that the wave-length of the latter will change. Reaction can be detected when a meter is used, by the fact that the needle climbs up slowly as the resonant point is approached and then drops down suddenly. If there is no reaction, the needle will climb slowly and then descend slowly, after the resonance point has been passed.

Results of the Radio Shower Party

(*Continued from page 625*)

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28—Frank P. Furst, Brooklyn, N. Y.
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30—Lawrence Oehler, Brooklyn, N. Y.
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34—W. J. Peterman, Brooklyn, N. Y.
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38—Fred Fettinger, Brooklyn, N. Y.
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40—James De Francisci, Brooklyn, N. Y.
41—John Langer, Brooklyn, N. Y.
42—Henry Wenzel, Brooklyn, N. Y.
43—A. N. Moser, Brooklyn, N. Y.
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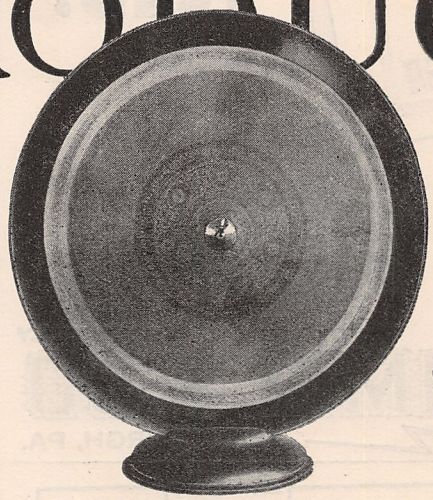

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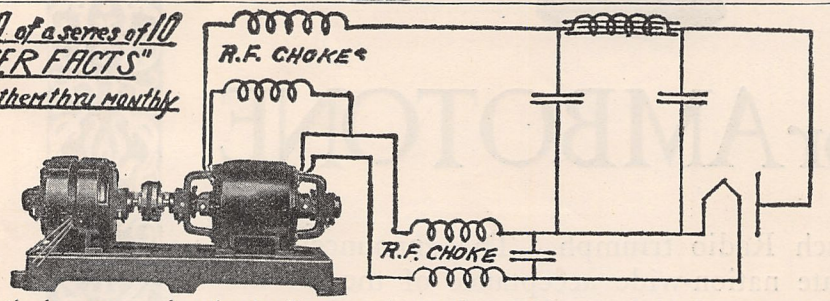

At the longer wave lengths the filters previously discussed have a double purpose. They are both a filter and a protective system against high frequency At the very low wave lengths it is advisable to insert at the generator terminals R. F chokes consisting of about 30 turns of large wire about 3 inches in diameter These tend to impede any high frequency that leaks back thru the small capacity of the windings of large chokes or from stray induction from the set. These should be placed in both the plate and filament supplies. In the filament supply a large condenser, as is shown, should be used.

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2—Gurdon F. Chatfield, New Haven, Conn.
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9—Halsted Candage, Middleboro, Mass.
10—John Burnham, Montague City, Mass.
11—Thomas Burnham, Montague City, Mass.
12—G. W. Hayward, Nantucket, Mass.
13—Wm. B. King, Needham, Mass.
14—Howland H. Sargeant, New Bedford, Mass.
15—Frank Berg, Meyersdale, Pa.
16—Edward H. Rigby, Media, Pa.
17—Chas. F. McClintock, McKeesrocks, Pa.
18—G. J. Lasher, Ormsby, Pa.
19—Rudolph Gerbec, Lloydell, Pa.
20—Harry W. McCarthy, Brooklyn, N. Y.
21—Clarence A. Bell, Lewistown, Pa.
22—Ralph Womer, Lewistown, Pa.
23—Edw. B. Daveler, Lancaster, Pa.
24—John Judd Shields, Lewisburg, Pa.
25—Denzil Royer, Lewisburg, Pa.
26—Fred C. Bowman, Lebanon, Pa.
27—S. E. Mognet, Leechburg, Pa.
27A—B. W. Benedict, Lansdowne, Pa.
28—Clark N. Witherup, Kennerdell, Pa.
29—Jas. E. Flynn, Kellettville, Pa.
30—Master Hiller Hahn, Johnstown, Pa.
31—Percy Hershberger, Johnstown, Pa.
32—H. B. Prest, Jenkintown, Pa.
33—Harold J. Marra, Jenkintown, Pa.
34—Arthur J. Beret, Jenkintown, Pa.
35—D. W. Seighman, Hunkers, Pa.
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51—Morris R. Lau, East Berlin, Pa.
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53—P. W. Collom, Drexel Hill, Pa.
54—J. S. Laughrey, Jr., Dawson, Pa.
55—Wm. H. Reick, Cressona, Pa.
56—Harold G. Coyle, Coudersport, Pa.
57—H. M. Morrison, Carlisle, Pa.
58—C. E. Ege, Carlisle, Pa.
59—J. Lawrence Jackson, Carlisle, Pa.
60—M. C. Cratty, Butler, Pa.
61—S. Austin Brobst, Bristol, Pa.
62—Clyde Adams, Blossburg, Pa.
63—Wm. B. Jones, Blossburg, Pa.
64—Fred R. Werkheiser, Bethlehem, Pa.
65—Richard W. Heisler, Ardmore, Pa.
66—Calvin Walck, Allentown, Pa.

ZONE 4

1—Walter G. Morrison, Baltimore, Md.
1A—Chas. W. Rogers, Akron, O.
2—Harry Apley, Barberton, O.
3—H. L. Gallagher, Cleveland, O.
4—H. J. Kohli, Spencer, O.
5—H. J. Hoffman, Columbus, O.
6—C. E. Marquart, Pittsburgh, Pa.
7—John E. Keene, Mont Clare, Pa.
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9—Miss E. M. Gray, Marietta, O.
10—Mrs. E. Kilgore, Bellaire, O.
11—C. O. Rhea, Bridgeport, O.
12—G. Tyler Sperry, Cleveland, O.
13—Hal McNichols, Columbus, O.
14—E. N. Hirsimaki, Conneaut, O.
15—Bennetts Garage, Conneaut, O.
16—J. E. Wilson, Frankfort, Ky.
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18—C. J. Rhea, Martins Ferry, O.
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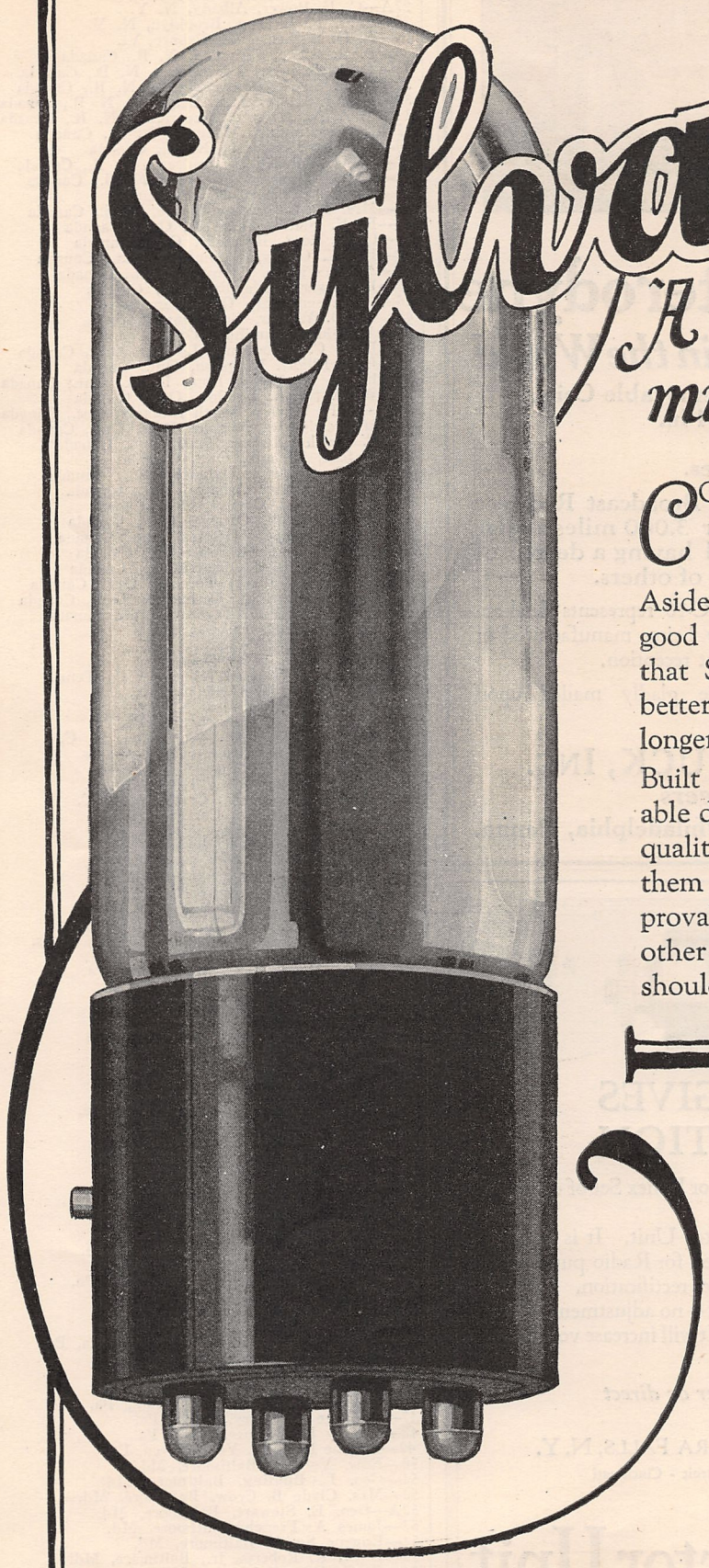

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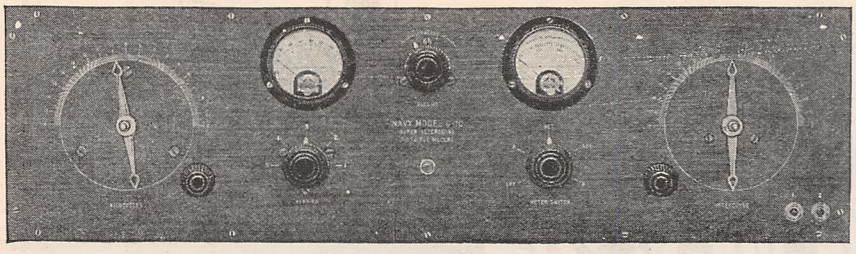

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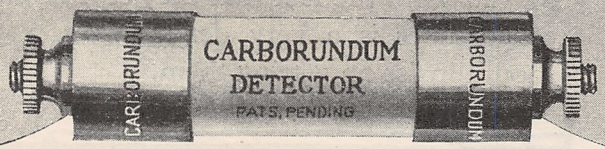

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13—W. Glenn McIver, Sanford, N. C.
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18—W. C. Lane, Jr., Sanford, N. C.
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30—L. G. Van Nostrand, Scranton, Pa.
31—Joseph R. Jordan, Scranton, Pa.
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33—Geo. D. Bressler, Shamokin, Pa.
34—Harold W. Abbott, St. Marys, Pa.
35—J. C. Barnhart, Sunbury, Pa.
36—Eugene J. Lynch, Susquehanna, Pa.
37—Thos. C. Shoupe, Tarentum, Pa.
38—Herman Himmelberger, Tremont, Pa.
39—W. A. Peterson, Warren, Pa.
40—O. B. Eyler, Waynesboro, Pa.
41—Harlan E. Crowell, Wayne, Pa.
42—H. B. Davenport, West Philadelphia, Pa.
43—Roy Searfoss, Wilkes-Barre, Pa.
44—E. P. Willson, Wyalusing, Pa.
45—Samuel Frankel, Wilkes-Barre, Pa.
46—William Shoemaker, Wyoming, Pa.
47—Eldridge F. Gerry, York, Pa.
48—Harvey L. Bortner, York, Pa.
49—Eugene Brunner, York Haven, Pa.
50—Edw. Voelker, Baltimore, Md.
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52A—Geo. E. Stewart, Baltimore, Md.
53—James A. French, Baltimore, Md.
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2—George S. Rigby, Media, Pa.
3—Edward Bell, Pompton Lakes, N. J.

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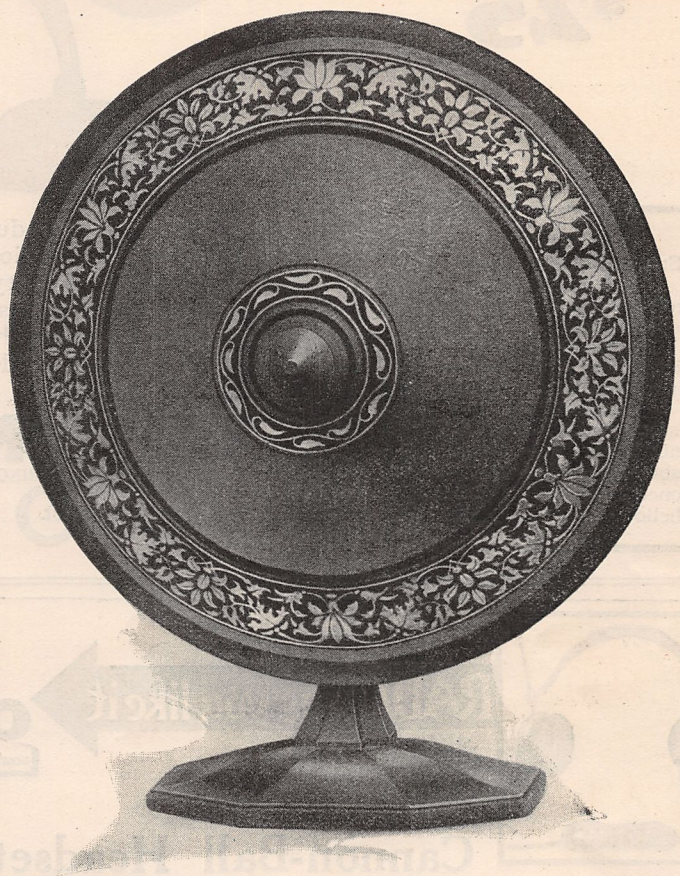
The Speaker of Perfect Tonal Values



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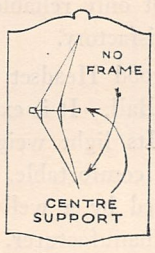
This, together with the use of two cones of unequal size and angle, gives the FITCH its remarkable clarity and fidelity of tone.

The entire audible range, from the high notes of the soprano to the deep tones of the bass, is reproduced with exceptional uniformity.

The FITCH speaker is a beautiful symmetrical, and artistic ornament, which harmonizes with any setting.

The unit is adjustable. It will not chatter or blast.

See and hear the FITCH at your dealers. If your dealer is not supplied, we can make immediate delivery.



$12.50

FITCH RADIO COMPANY

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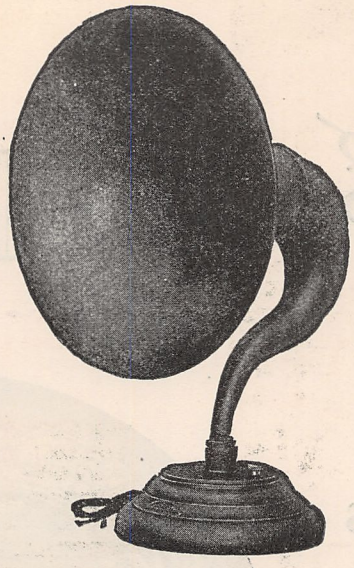
TRIMM Concert $25



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Dependable - - - 4.40

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Home Speaker - $10.00
Entertainer - - 17.50
Cabinette - - - 17.50
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TRIMM Concert reproduces all the tones, from high of violin to low of organ, with perfect fidelity. Easily accessible adjustment permits control of tone and volume. Volconite horn eliminates scratchy overtones and noises.

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RADIO MANUFACTURING COMPANY
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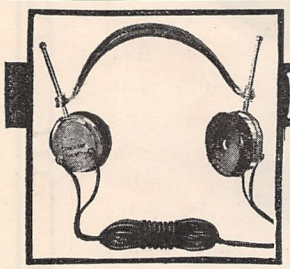

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Clearness and perfection of reception are among the many reasons why you'll enjoy Radio as you like it through a Headset. By reducing the volume, the beautiful notes of music or the words of the speaker are brought out clearly. And for long distance reception, the Headset is not only reliable but is far more satisfactory.

Buy a good Headset such as the Cannon-Ball. It is extremely sensitive. Its light weight helps to make it comfortable. And it is guaranteed by a well established, reliable manufacturer.

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35—Bessie A. Wilson, Arlington, Va.
36—Frank Hill, Clifton Forge, Va.
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38—R. C. Peck, Herndon, Va.
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2—J. Farnum Brown, Wellsville, N. Y.
3—Carl W. Brandon, New York City
4—Edward J. Daly, New London, Conn.
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6—D. Kern Einfurer, Brooklyn, N. Y.
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10—Floyd Baker, Syracuse, N. Y.
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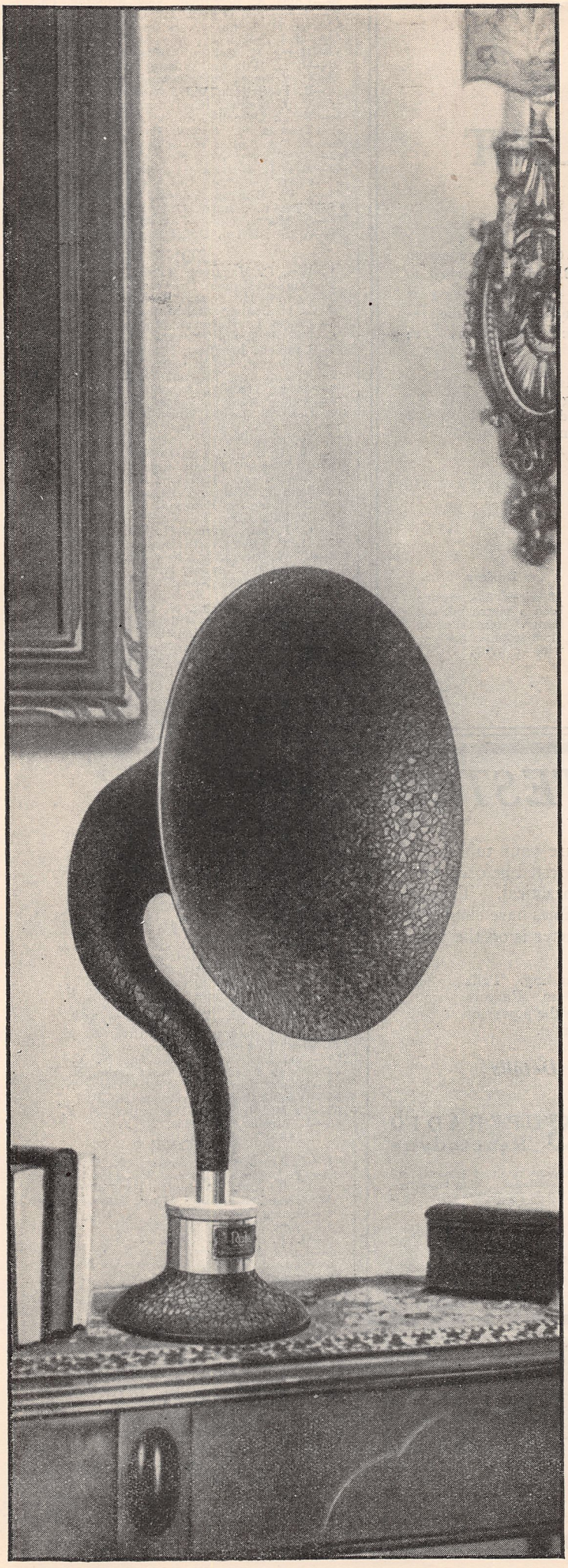
12—T. P. Jones, Cumberland, Md.
13—Paul Amtower, Cumberland, Md.
14—Stf. Sgt. James R. Sanders, Edgewood Arsenal, Edgewood, Md.
15—Carl Orndorff, Gaithersburg, Md.
16—Maurice Gue, Germantown, Md.
17—Edwin M. Gue, Germantown, Md.
18—George Fraser, Cumberland, Md.
19—Wilbur F. Yingling, Finksburg, Md.
20—L. H. Odell, Glen Echo, Md.
21—Elliott Haines, Jr., Hagerstown, Md.
22—Wm. Brauns, Odentown, Md.
23—C. A. Bischoff, Parkton, Md.
24—Miss Cecelia Fiedler, Parkton, Md.
25—Manson W. Owens, Pittsville, Md.
26—Hermann E. Hobbs, Silverspring, Md.
27—Powell Wrightson, St. Michaels, Md.
27A—J. C. Harper, St. Michaels, Md.
28—Roland C. Plummer, St. Michaels, Md.
29—Kenneth Fretz, Pleasant Valley, Pa.
30—Wm. Richardson, Pittston, Pa.
31—Oscar Mettinet, Pittsburgh, Pa.
32—N. F. Schmidt, Pittsburgh, Pa.
33—Wm. Marlin, Pittsburgh, Pa.
34—R. Blumenthal, Pittsburgh, Pa.
35—C. Stirling Dunning, Pittsburgh, Pa.
36—Frank McAdams, Philadelphia, Pa.
37—Theodore F. Leichner, Philadelphia, Pa.
38—Thomas A. Kemmy, Philadelphia, Pa.
39—Eugene G. Healey, Philadelphia, Pa.
40—Samuel H. Bloom, Philadelphia, Pa.
41—Wm. B. Gibson, Philadelphia, Pa.
42—John Kriegshausser, Philadelphia, Pa.
43—Harry Rutberg, Philadelphia, Pa.
44—Louis A. Dearden, Philadelphia, Pa.
45—Francis J. O'Brien, Philadelphia, Pa.
46—Ed. W. Goldstein, Philadelphia, Pa.
47—D. W. Kemble, Parsons, Pa.
48—T. Ellwood Livezey, Norristown, Pa.
49—Geo. S. McEllroy, New Castle, Pa.



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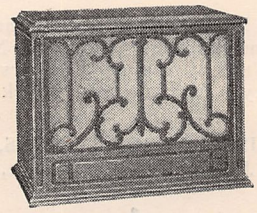
Re★creation is radio's destiny fulfilled



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The Rola is *created* for the re*creation of voice and music. From the time the first fine materials reach the hands of the Rola experts, until they have become the finished Rola Re*creator—painstaking care and the true craftsman's love for his work color every operation. Assuring precision. Approaching perfection. Small wonder that the Rola alone is called a Re*creator. And that it charms and captivates all who hear it.

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now offers the

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All fans remember the pioneer of adjustment units—Morrison Model C. For 3 years this unit was a standard of comparison. In trend with radio's great growth Morrison now offers the Mocking Bird Unit, the peer of all units.

You cannot equal the tone reproduction of the Mocking Bird Unit attached to the phonograph. Radio assumes new delights—purity of tone and the remarkable volume (adjustable) are marvelous.

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Attractive quantity prices on Units to build into your Sets.

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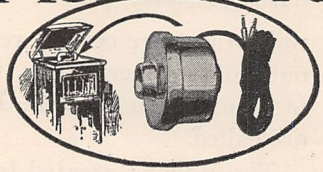

Loud Speaker

Dealers

Morrison has always been a merchandising leader. New schedule of discounts ready—wire or write.

SEE YOUR TUBES TESTED

There's only one way to be sure your tubes are RIGHT and that's to see them tested before your eyes. Formerly, this was impractical. Tricky curves had to be figured. But times have changed now that the Superadio Dynometer is on the job.

This Dynometer is direct reading. Tells if tube is gassy, underaged, etc. Easy to operate. Positively measures the power of any tube on the market.

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SUPERADIO Super-heterodyne KIT

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2—Wm. S. Hunter, Goodyear, Conn.
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4—F. C. Bonnert, Baltimore, Md.
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6—Mrs. I. Lange, Newark, N. J.
7—Laurence Brauman, Secaucus, N. J.
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9—R. Lefebvre, Teaneck, N. J.
10—George Marsilio, Ridgefield Park, N. J.
11—Arthur Marsilio, Ridgefield Park, N. J.
12—Geo. W. Jacobs, Rochelle Park, N. J.
13—L. Stanford, Red Bank, N. J.
14—W. R. Williams, So. Plainfield, N. J.
15—W. C. Smith, Pleasantville, N. J.
16—J. Jezersky, Phillipsburg, N. J.
17—John Berger, Paterson, N. J.
18—John T. Winter, Paterson, N. J.
19—B. Rosenfelt, Paterson, N. J.
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21—C. F. Kay, Nutley, N. J.
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26—Ray C. Booth, Newark, N. J.
27—S. Crane, Newark, N. J.
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29—J. T. Lansing, Montclair, N. J.
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35—Arthur W. Zeledon, Jersey City, N. J.
36—M. E. L. Hooven, Jersey City, N. J.
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38—A. T. Brouillard, Jersey City, N. J.
39—Joseph Hoeflinger, Jersey City, N. J.
40—Thomas Foley, Jr., Hoboken, N. J.
41—M. Echlin, Hawthorne, N. J.
42—R. D. Reed, Hamilton Square, N. J.
43—A. M. Larsen, Hampton, N. J.
44—John Waldron, Harrison, N. J.
45—Mrs. E. Klance, Haledon, N. J.
46—Chas. Thielmann, Guttenberg, N. J.
47—R. F. Segerberg, Elizabeth, N. J.
48—John McDougall, Elizabeth, N. J.
49—Melvin J. Koestler, Elizabeth, N. J.
50—Robert W. White, Edgewater, N. J.
51—Charles C. Sheppart, Collingwood, N. J.
52—R. A. Carkon, North Caldwell, N. J.
52A—Wm. H. Vogel, Jr., Caldwell, N. J.
53—E. B. Garrison, Bridgetown, N. J.
54—J. C. Ewen, Bogota, N. J.
55—Harold C. Deucher, Arlington, N. J.
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59—Gerald Bergmeyer, Whitehall, N. Y.
60—John L. Forrest, Windsor, N. Y.
61—Carl Kroyer, West Linden, N. Y.
62—Irving Friedman, West Copake, N. Y.
63—Willard Lowinson, West Copake, N. Y.
64—Wm. Aitken, Watertown, N. Y.
65—C. M. McQuaid, Watertown, N. Y.
66—E. Mosher, Waterloo, N. Y.

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1A—T. J. Crosby, Toronto, Ont., Can.
2—C. B. Aikin, Bellveille, Ont., Can.
3—Armand Nedeau, Ludlow, Mass.
4—Ebwing Perry, Millway, Mass.
5—Harry P. Clark, Vestal, N. J.
6—G. A. Bradley, Utica, N. Y.
7—Leroy A. Francis, Utica, N. Y.
8—Edward J. Frank, Schenectady, N. Y.
9—Frank E. Hagis, Utica, N. Y.
10—Harry Walker, Utica, N. Y.
11—Foster K. Brown, Utica, N. Y.
12—Geo. A. Croak, Utica, N. Y.
13—J. Frederick Jones, Tarrytown, N. Y.
14—C. S. Maynard, Syracuse, N. Y.
15—Mrs. E. Green, Syracuse, N. Y.
16—Clarence Mahony, Syracuse, N. Y.
17—Joseph B. Fowler, Syracuse, N. Y.
18—W. C. Fells, Syracuse, N. Y.
19—G. A. Baker, Syracuse, N. Y.
20—Frank J. Horning, Syracuse, N. Y.
21—George E. Hoakes, Syracuse, N. Y.
22—Harvey R. Esler, Syracuse, N. Y.
23—G. E. McCaffer, Syracuse, N. Y.
24—M. A. Lynk, Sharon Springs, N. Y.
25—Frank G. Bunnel, Syracuse, N. Y.
26—Frank Euckson, West New Brighton, N. Y.
27—James Flemming, West New Brighton, N. Y.
27A—C. A. Ehren, Jr., West New Brighton, N.Y.
28—Miss L. Fenton, Stapleton, S. I., N. Y.
29—Walter J. Gyngell, Saratoga Springs, N. Y.

Pfanstiehl Introduces 6-Tube OVERTONE Receiver

With Translucent Station Finder

LAST year Pfanstiehl perfected the Overtone Receiver—an accomplishment of the first importance, which radio engineers had vainly attempted hitherto. He did so by eliminating all clashing of radio energy inside the set, thereby insuring a smooth, forward flow of the radio stream from circuit to circuit. The super vibrations of radio energy are thus kept intact, exactly as received, and there is no blurring or marring of the resulting overtones which bring out the beauty of voice and music.

This year he went a step further. He still further protected the overtones by an overtone loudspeaker inbuilt and sympathetically adjusted to the receiver itself. Modulation is made perfect. Even through a detached speaker the tone was far superior to any other obtainable in long distance reception. Now it is supreme.

Single Dial More Efficient Than Any Multiple Control

His single dial control immeasurably simplifies radio. It will give it a new popularity with the great mass of home users who are inexpert and dislike complicated tuning. It has been made possible by the very same mastery of radio energy in and between circuits which perfected overtone reception. With no leakage of energy to disturb the electrical characteristic of the radio stream on its way through each circuit, THERE ARE NO INEQUALITIES. Each circuit is electrically like every other—ALL tuned by one turn of the Pfanstiehl triple unit condenser.

Without the simple, equalized circuit of the Pfanstiehl system, no efficient one dial control is possible in a radio frequency set. Stray energy and the devices employed to neutralize it create inequalities in the circuits which THEN REQUIRE SEPARATE TUNING.

It thus becomes apparent how important an advance Pfanstiehl made in simplifying the radio frequency circuit and eliminating all compensating or neutralizing devices. It made possible perfect overtone reception, simple and dependable operation and now—single dial control.

Actual Wave Length GLOWS from Illuminated Dial—No Scale Necessary

An unique feature of the overtone panel in all models is the illuminated station finder disc which revolves with the tuning knob and registers in actual wavelengths rather than in arbitrary numbers. The disc is concealed except for a small opening in the panel where the wavelength appears, the disc being translucent and illuminated from behind. Extremely convenient; enables tuning to be done in the dark; shows whether power is on or off; adds a brilliant touch to the panel assembly. Panel is of wood, five ply construction, finished like rest of cabinet. Much handsomer than bakelite or rubber. Control and volume dials of inlaid wood. All exposed metal parts gold plated.

An Exclusive Franchise

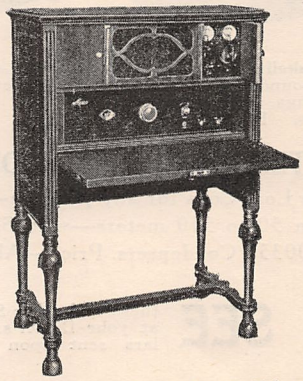
The Pfanstiehl line is sold through exclusive dealers and jobbers who are thus protected against unfair competition and price cutting. Whatever good-will the dealer or jobber builds up for Pfanstiehl is his own. He enjoys a liberal profit and is expected in return to push the line aggressively with the cooperation of the maker.

For further details, address

PFANSTIEHL RADIO COMPANY

11 South La Salle Street, Chicago, Illinois

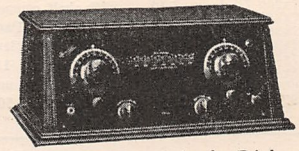
Prices West of the Rockies Slightly Higher



MODEL 10C—A complete 6-Tube Single-dial Console Receiver with Overtone Speaker, Control Board, Battery Charger and Compartments for Battery built in. Price $450.00 (less tubes and batteries).

MODEL 10S—Overtone Single-dial 6-Tube Receiving Set with demountable Console Stand. Overtone Speaker built in. Price $200.00 (less tubes and batteries).

MODEL 10—An Overtone Single-dial 6-Tube Receiving Set. Price $155.00 (less accessories).

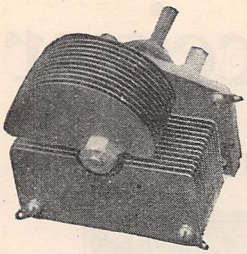


MODEL 8—A low priced 2-Dial 5-Tube Receiving Set, Pfanstiehl quality throughout. Price $85.00 (less accessories).

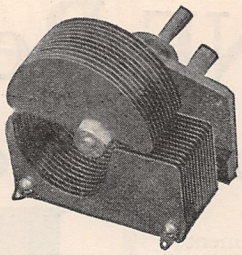
ALSO

MODEL 8C—Two-dial 5 Tube Receiving Set, demountable from console stand, permitting use on floor or table. Overtone Speaker built in. Price $135.00 (less tubes and batteries).

SM PARTS Again



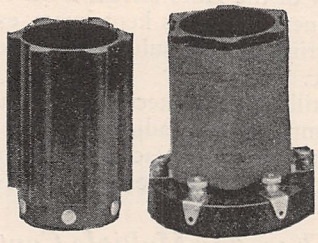
Bakelite Coil Form
Unwound with rotor, springs and six contacts. Price $1.25



Six Contact Bakelite Inductance Socket $1.25

Silver-Marshall leads with the finest straight line frequency condensers yet produced. All losses — dielectric, eddy-current, surface-resistance — are unbelievably low. Six sizes both SLW and SLF priced from $4.50 to $6.00.

Guyed Sockets
A radically new cushioned socket for all UX or UV tubes except UV 199. Price...$1.00



INTERCHANGEABLE INDUCTANCES

Low Loss Coils for any purpose—for all waves from 50 to 550 meters—with SM 306 or 311 (.00035) Condensers. Price—All Types $2.50.

SEE these and other SM Parts at your Dealer's. Circulars sent upon request.

SILVER-MARSHALL, Inc., 116 S. Wabash Avenue **CHICAGO**

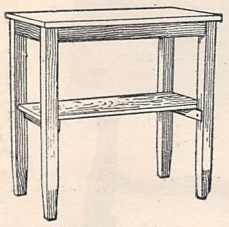
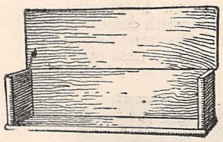


TABLE NO. 31
Substantial table 15"x31" x29". Packed 1 each in carton $3.50



SPECIFICATIONS AND PRICES

Panel 7x 9" 7" deep	$1.80
Panel 7x12" 7" deep	2.00
Panel 7x14" 7" deep	2.25
Panel 7x16" 7" deep	2.30
Panel 7x18" 7" deep	2.40
Panel 7x21" 7" deep	2.50
Panel 7x24" 7" deep	2.60
Panel 7x26" 7" deep	2.70
Panel 7x28" 7" deep	2.80
Panel 7x30" 7" deep	3.25
Panel 7x36" 7" deep	4.75
Panel 7x40" 7" deep	5.25
Panel 8x40" 8" deep	5.75
8 or 9" panels add	30%
8 or 9" deep add	30%

M-B-G RADIO CABINETS

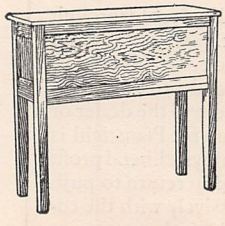
For your RADIO SET

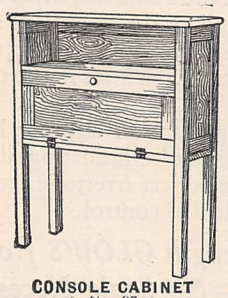
Get an MBG Cabinet for your set today. Any size you need at ridiculously low prices. All our cabinets are strongly made from beautifully grained Douglas Fir. Shipped in the natural wood with full instructions for staining at home to harmonize with 24 standard wood finishes. Make your radio set an attractive piece of furniture at low cost.

Radio Cabinet Department

Express Body Corporation
42 Lake Street **Crystal Lake, Ill.**

CABINET NO. 29
Battery compartment 10" x 11" x 29" open back with shelf compartment for B Battery. Panel front to conceal batteries, over all measurements 11½" x 32" x 29". Set up complete in carton, $7.50.





CONSOLE CABINET
No. 37

Panel Size	Dep	Bat. Comp.	Price
7x18"	9"	10x11x18"	$10.50
7x24"	9"	10x11x24"	11.50
7x26"	9"	10x11x26"	11.50
7x28"	9"	10x11x28"	11.50

Additional door makes shelf in front of panel when open, extra...$3.00
No. 37 two-door console for 5 tube Atwater-Kent set

Panel Size	Depth	Bat. Comp.
8x50"	10½"	10x11x30"

Price $17.50
To fit 6-tube Atwater-Kent

Panel Size	Depth	Bat. Comp.
8x36"	10½"	10x11x36"

Price $20.50
Mounting boards, each 50c
Shipped set up complete, one to a carton.

Prizes For You

Boys and Young Men—You can earn dandy prizes and liberal commissions by selling and delivering our popular magazines in your spare time. No experience or money is necessary. We furnish all supplies and tell you just how to start. *Write to-day.*

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6—Benjamin Levine, New York City.
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Equip your set with Balkite Radio Power Units

They provide unfailing, uniform current for both circuits

Equip your set with Balkite Radio Power Units. They improve and simplify radio reception. With their use your current supply is unfailing and always exactly what is required for each circuit. They reduce the amount of attention you give your set.

The Balkite Battery Charger is entirely noiseless in operation. It can be used while the set is in operation.

The Balkite Trickle Charger is especially adapted to sets of small "A" current requirements—any dry cell set, and storage battery sets of few tubes. It enables owners of sets now using dry cells to make a most economical installation.

Balkite "B" II is also well known. It was the outstanding development in radio last year. It eliminates "B" batteries and supplies plate current from the light socket. It fits any set.

The new Balkite "B" at $35 is especially designed to serve sets of 6 tubes and less. With such sets it will perform exactly as does Balkite "B" II with sets of larger "B" current requirements.

Noiseless—No bulbs—Permanent

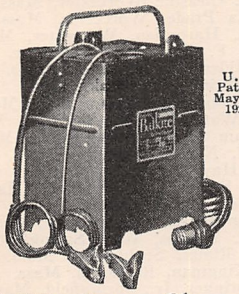
All Balkite Radio Power Units are based on the same principle. All are entirely noiseless in operation. They have no moving parts, no bulbs, and nothing to adjust, break or get out of order. They cannot deteriorate through use or disuse—each is a permanent piece of equipment with nothing to wear out or replace. They require no other attention than the infrequent addition of water. They do not interfere with your set or your neighbor's. Their current consumption is remarkably low. They require no changes or additions to your set.

An "A" battery, a Balkite Charger and a Balkite "B" constitute a complete, trouble-free radio power equipment, one that is economical, unfailing in operation, and eliminates the possibility of run-down batteries.

Manufactured by
FANSTEEL PRODUCTS COMPANY, Inc.
North Chicago, Illinois

FANSTEEL
Balkite Radio Power Units

FOR THE "A" CIRCUIT

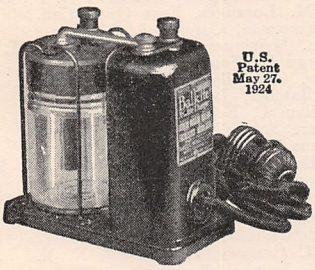


U. S. Patent May 27, 1924

Balkite *Battery Charger*

This popular battery charger can be used while the radio set is in operation. If your battery should be low you merely turn on the charger and operate the set. Charging rate 2.5 amperes. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles. Also for 25-40 cycles with 1.5 charging rate.

Price $19.50
West of Rockies, $20
In Canada, $27.50



U.S. Patent May 27, 1924

Balkite *Trickle Charger*

Charges both 4 and 6 volt radio "A" batteries at about .5 amperes. Usable in 3 ways: (1) As a regular charger with a low capacity storage battery for sets now using dry cells. (2) With storage battery sets of few tubes. Furnishes more current than used by 6 dry cell or 2 storage battery tubes, so that if used during operation it need be used at no other time. (3) As a "trickle" or continuous charger for sets of as many as 8 dry cell or storage battery tubes. Sizes 5½ in. long, 2¾ in. wide, 5 in. high. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Reputable manufacturers are also offering this fall for use with this charger special switches which turn on Balkite "B" and turn off the charger when you turn on your set. This makes the current supply for both "A" and "B" circuits automatic in operation.

Price $10
West of Rockies, $10.50
In Canada, $15

FOR THE "B" CIRCUIT

U. S. Patent May 27, 1924

Balkite "B"

Eliminates "B" Batteries. Supplies plate current from the light socket. Operates with either storage battery or dry cell tubes. Keeps "B" circuit always operating at maximum efficiency, for with its use the plate current supply is never low. Requires no changes or additions to your set. No bulbs—nothing to replace. Requires no attention other than adding water twice a year.

A new model, designed to serve sets of six tubes or less. Size 8¼ in. long, 8 in. high, 3¼ in. wide. Occupies about same space as 45 volt dry "B" battery. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price $35
In Canada, $49.50

U. S. Patent May 27, 1924

Balkite "B" II

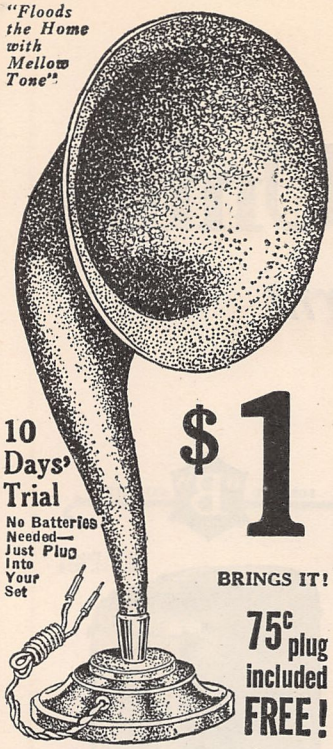
The most outstanding development in Radio last season. Same as the new Balkite "B" but will fit any set including those of 8 tubes or more. Current capacity 40 milliamperes at 90 volts. Size 9 in. high, 6¼ in. wide, 7½ in. deep. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price $55
In Canada, $75

The Unipower, manufactured by the Gould Storage Battery Company, is equipped with a special Balkite Radio Power Unit.

BALKITE BATTERY CHARGER · BALKITE TRICKLE CHARGER · BALKITE "B" · BALKITE "B" II

"Floods the Home with Mellow Tone"



"The Song-Bird of Loud Speakers!"

Songster LOUD-SPEAKER

HORN The Horn is made of treated **FIBRE** that lends mellowness, softness, sweetness. It actually absorbs harsh, coarse sounds. It is **NON-RESONATING, NON-VIBRATING. It AMPLIFIES** and **BEAUTIFIES**, and recreates **FAITHFULLY** and **CLEARLY** the high notes of the singer, the sweet tones of the violin, the stirring march of bands, the natural inflections of the orator—and delightful richness of concert music. To own the **ORIOLE** is like having a **SONG-BIRD** in your home.

UNIT The Unit is super-sensitive—with resilient Diaphragm, and special electro-magnets that amplify **POWERFULLY.** There is a patented PRECISION adjustor to regulate reception from faintest whisper to **thunderous volume.**

DESIGN The graceful lines of the "SONGSTER" were designed by acoustic experts—and patterned after the shapely throats of the Oriole, the Nightingale and other song birds. Height 28 inches. Solid CORINTHIAN style base with cords attached. We have sold hundreds to delighted customers.

Usually sells for $20. We have just 792 of them. OUR PRICE WHILE THEY LAST.....$13.85 Sent on 10-DAY FREE TRIAL! You pay only $1 Now! Yes, only $1 NOW; because we want you to SEE IT! HEAR IT! ENJOY IT!—before paying more money. If pleased, you may pay at the rate of

$3 A MONTH

or, if you wish to pay cash, take $1.20 discount and send check or money order for..... $12.65

ORDER NOW! ONLY 792 AT THIS PRICE! SEND ONLY $1 NOW! MAIL THIS ADV. TODAY

10 Days' Trial

No Batteries Needed—Just Plug Into Your Set

$1 BRINGS IT!

75c plug included FREE!

2 Generations of Honorable Dealings

WASHINGTON JEWELRY Co.

Importers and National Mail Order House

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For prompt attention address RADIO Dept. 96

Gentlemen: Please send me $13.85 "SONGSTER" Loud-Speaker. I enclose $1 first payment. If I am satisfied after 10 DAYS' TRIAL, I have the privilege of paying for it at the rate of $3.00 monthly—or of deducting $1.20 and sending $12.65 in FULL PAYMENT. Otherwise, I shall return it, and my $1 will be refunded.

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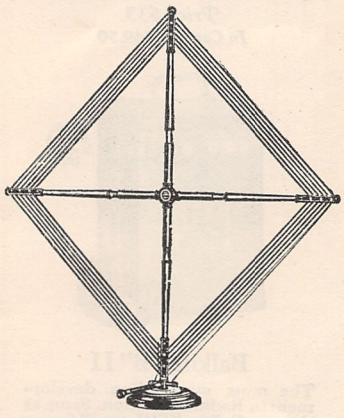
Please write PLAINLY! Tear this Advertisement out now! If you wish to tell us something about yourself, it will be appreciated. RN-11-25

Eliminate Interference



A loop aerial gives you perfect control over your set, permits sharper tuning, improves reception and reduces static. It does away with unsightly wires inside and outside the home. Because of the new and exclusive features in its construction radio experts prefer the

BODINE BASKET WEAVE FOLDING LOOP

The silk insulated, stranded wire is basket wound, preventing losses and delivering more energy to set. The Bodine is very sensitive, has insulated handle for turning loop, and a calibrated dial permits accurate directional logging of stations.

The better radio dealers are prepared to supply you a Bodine Loop designed to give perfect service with your particular set. Excellent for Remler Super Het; special models for Grebe Synchrophase and Radiola Super Het. Prices $8.50 to $10.

When set up, the Bodine Folding Loop is two feet square. The wire is double-wrapped in green silk and the frame is a beautiful brown mahogany finish. The Bodine easily folds into a box measuring only 5½ x 6 x 18 inches.

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39—J. D. Nichols, Long Island City, N. Y.
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Your set at its best *always* with a Super-Ducon

—the "B" Battery Substitute

When guests come in, your set is ready. No run-down "B" batteries—no batteries being recharged. There's the Super-Ducon plugged into the light socket—ready to deliver a steady, silent flow of current.

It's the perfect substitute of "B" batteries—equipped with a specially designed RCA tube (Rectron UV-196) that has an average life of more than 1000 hours. It's a thoroughly efficient device—made and backed by Dubilier. And it *keeps* your set at its best!

Tested and listed by the National Board of Fire Underwriters.

Dubilier

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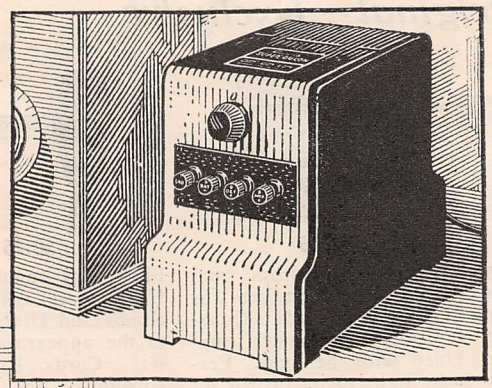

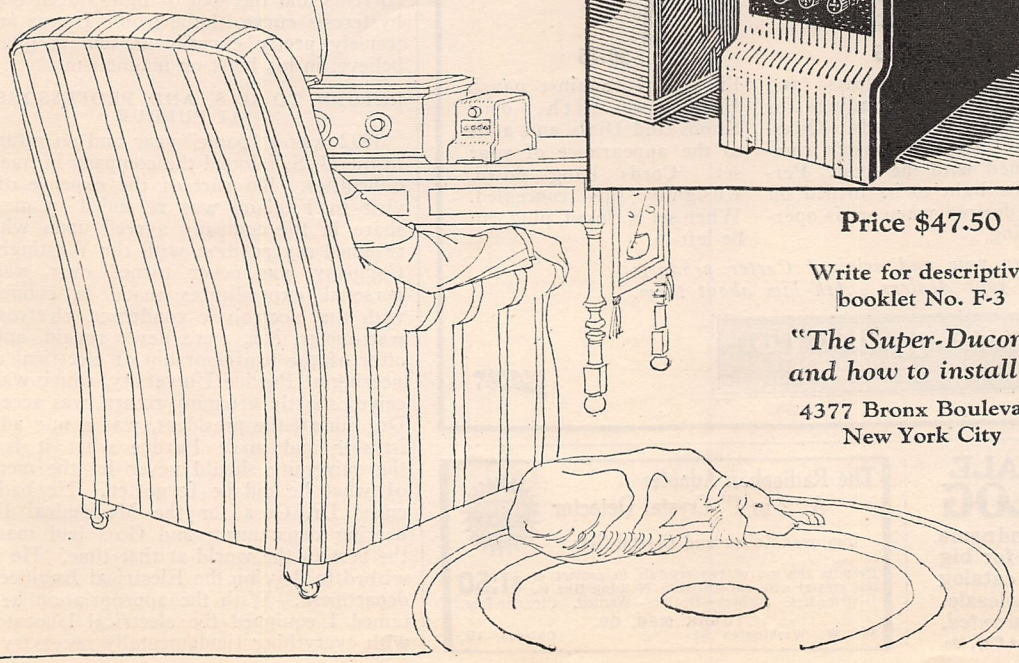

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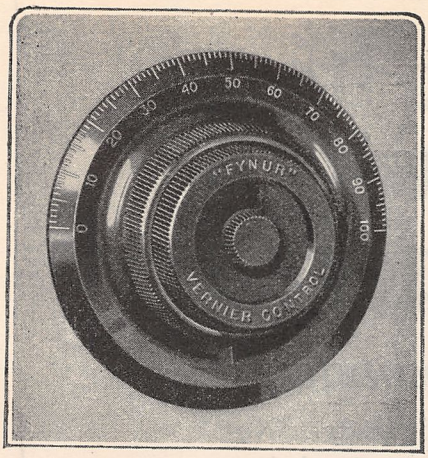
A Set Is As Good As Its Dials



The Fynur Vernier Control is accurate to a hair's breadth. There is positively no backlash or lost motion.

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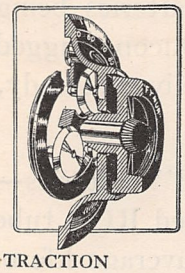

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Your set can be no better than its dials, so have the best set by having the best dials.

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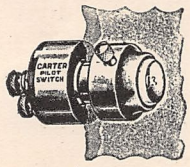

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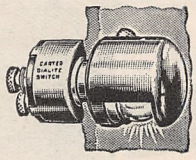
A red Pilot light shows when your "A" battery is "On"—no excuse for going away and leaving your tubes burning. Single hole mounting, quarter turn switch — compact. Simple. Carter quality.

"Dialite"



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Eliminates shadows and permits exact readings for logging your dials. Quarter turn snap switch combined with the light. Permits light to be turned off if desired when set is operating.

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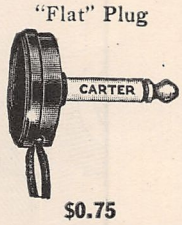

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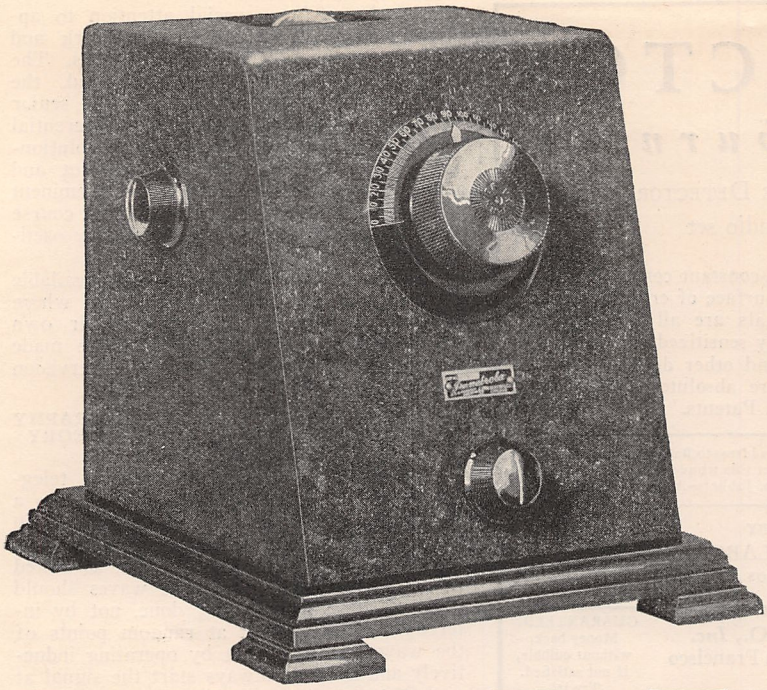
The Inventions of Reginald A. Fessenden

(*Continued from page* 591)

steam prime mover, the steam turbine, which Parsons was operating at Newcastle. This I did, and concluded that it would take the place of the steam engine for central station work. A side trip to Cambridge was very interesting. J. J. (now Sir Joseph) Thomson was found in his laboratory, the Cavendish laboratory where Maxwell had worked. Thomson showed me some of Maxwell's apparatus, and I saw some of Thomson's experiments on vacuum tubes. I mentioned some work I had done on an electric furnace, in which the graphite crucible had been made the secondary of a transformer and the heat so produced and he showed a crucible that he had used as a resistance for absorbing oscillatory discharges, and I referred to my own work on making an electrodeless vacuum tube lamp. Then came up the question of the electrostatic doublet theory of cohesion, which Thomson said he could not accept. I pointed out that in his book on "Dynamics Applied to Chemistry" he had given some formulae for conduction which were not at variance with the electrostatic doublet theory, but he held that all conduction in gases, liquids and solids, was electrolytic and that charges could not exist inside of conductors except when conducting a current. While we were talking Ewing came down, and said he wished to show Thomson something he had just got to work, and I was invited to go along. We came into a dark room where Ewing showed us a wound iron ring whose hysteresis he was determining, the windings connected to a galvanometer whose mirror threw a spot of light on a screen. He turned the handle of a zinc plate arrangement which produced slow alternating currents and the spot of light traced out the hysteresis curve of the iron. It was an extremely pretty experiment, and is given, I believe, in his book on magnetism.

RETURN TO U. S. AND PROFESSORSHIP AT PURDUE

1892 was a "panic" year and on returning to the U. S. I found the company in financial difficulties. No part of the expense of the visit to England was refunded to me, the share in the company agreed upon when I resigned my position with the Westinghouse Company was never turned over, various personal expenditures made in connection with the electrolytic condenser, electrostatic watt-meter, etc., were never repaid, and an offer of the professorship of electrical engineering at Purdue University, which was received shortly after my return, was accepted. Dr. Smart, the president, was a fine administrator and made Purdue what it is and the university should never let the memory of what he did be forgotten. He had secured Dr. Goss for the Mechanical Engineering department, and Goss had made it the best in the world at that time. He next wished to develop the Electrical Engineering department. With the appropriation he obtained I equipped the electrical laboratories with everything fundamentally necessary for



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Without Penetrola the signal intensity of WOAI was 11, on the Audibility Meter—an impartial precision measuring device. With Penetrola the signal intensity of WOAI jumped above 2000—188 times the signal strength!

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This is just exactly the sort of thing any Penetrola demonstration will show you on any set with any number or arrangement of stages. The wanted station is immensely intensified; interference is overwhelmed by Penetrola. There is so much volume available for the most distant signals that a shorter aerial may be used, curing excess static. Your set is stopped from radiating, and is stabilized. It is needless to operate near the oscillation point. And dial readings stay substantially the same.

Radio principles known to be of immense promise, but hitherto elusive, are now successfully applied by Walbert Penetrola. The widely heralded Isofarad Circuit, latest development of Walbert engineers, is the foundation of Penetrola performance. Here is one radio appliance literally unduplicated in any way by anybody, because there is no other Isofarad circuit. Nor is there any substitute for Penetrola action, which amplifies *ahead* of the detector entirely, strengthening signals which would otherwise never be detected! Remember, signals too weak to detect cannot be amplified by any means placed *beyond* the detector.

In a few moments any receiver, however costly, can be transformed with Penetrola. Or anyone can quickly assemble the Penetrola kit and obtain amazing Penetrola results most economically. The Penetrola price buys performance which cannot be obtained with any amount of investment in a receiver alone.

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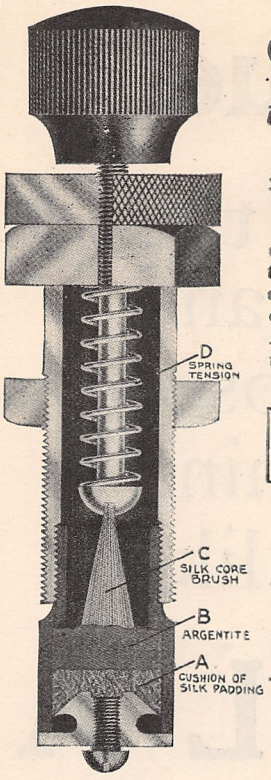

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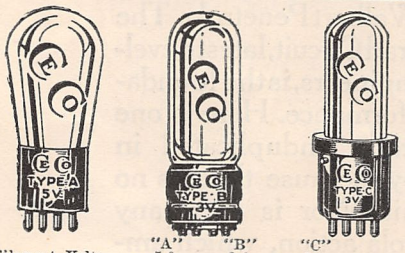

	"A"	"B"	"C"
Filament Volts....	5.0	3.0	3.0
Filament Current.	0.25	.06	.06
Plate Voltage.....	20 to 120	20 to 80	20 to 80

Made with Brass and Bakelite Bases

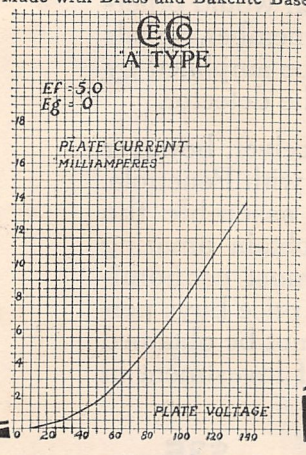

Chart shows plate current (CeCoA corresponding to 201A Type) in Milliamps at a filament terminal potential of 5 Volts and at plate potential between 0-140 Volts.

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THE EXPERIMENTER PUBLISHING CO., 53 Park Place, New York. N. Y.

the work, paying especial attention to apparatus for alternating current work and for precise measurements of all kinds. The mathematical work was emphasized, the students being supposed to enter the senior year with a fair knowledge of differential equations, which was considered revolutionary then. The men were a fine lot and many of them have since become eminent in their profession. There was also a course on the work of Hertz, high frequency oscillations, resonance, etc.

A certain amount of time was available for personal scientific work and also where students had no preference of their own as to thesis work, suggestions were made as to the line, and assistance and supervision given in working it out.

MULTIPLEX RESONANT TELEGRAPHY —ELECTRIC ANEMOMETER, THEORY OF MICROPHONE

The work on multiplex resonant telegraphy was taken up again and carried to a successful conclusion. It is referred to in the *Electrical World*, September 15, 1894. The more important results were, as stated in that article, that pure sine waves should be used and the signaling done, not by interrupting the current at random points of the wave by a key, but by operating inductively and so as to always start the signal at a definite point in its phase, generally the zero point.

Another device was an electrical anemometer, consisting of a wire heated electrically so that its temperature and ohmic resistance increased a definite amount, the current necessary to do this depending upon and being a measure of the wind velocity; it was standardized by fastening it to a rotating arm.

Another set of tests was made to determine the mode of action of the carbon microphone. The results will be found in the *American Electrician* for February and May, 1897. Other work on this line will be referred to later.

FESSENDEN FILAMENT GALVANOMETER

Perhaps the most important development was the invention of the filament galvanometer. Calculations on galvanometers showed that there was no advantage in using a coil of wire for the moving element, as though with, say 1,000 turns, there was 1,000 times the force of a single turn, they weighed more than 2,000 times what a single half-turn of straight wire did, also optical calculations showed that the motion of the single fine wire could be observed just as accurately as that of the coil by its mirror and scale. So one was constructed, as shown in Fig. 7, and worked extremely well and was described in a paper read before the Indiana Physical Society in 1892. Later a German scientist, Einthoven, made a similar galvanometer, but using silvered quartz thread instead of fine gold wire. But the great mass of the non-conducting quartz as compared with the silver coating made it much less sensitive and accurate than the original form above described, which has been used, with gold wire 1/10,000 inch in diameter, for recording each individual wave of wireless messages and for recording frequencies up to 50,000 per second and more. It also forms the one type of shutter of the writer's pallograph or wireless moving picture transmitter and receiver as it is the only method so far known which will modulate a light beam in one-millionth of a second, and a rapid shutter of this kind is necessary for the operation of the pallograph, or "radio-telescope."

A theoretically, and practically important investigation was the experimental verification of a theorem of Fourrier's, given in his "Theory of Heat," that if a hot body were surrounded by a series of thin sheet metal spheres or boxes, each shell or box would permit only one-third of the heat reaching it to pass outward. This theorem

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About the Marvels of Radio—How it Helps All and Brightens Every Home—Gives List of Broadcast Stations—Specimen Programs—And How Programs are Made UP—Answers the Questions, "What Set Shall I Buy," and How Much to Pay—Describes "No-Sod-er" Wiring System—Explains How to Get Your Own Radio Outfit Without Money—How to Save $65.00 in Five Hours—How to Make Money by Going Into Business for Yourself and Building Sets for Others—Tells Where Orders are Awaiting You—Where and How You Can Transact Your Business—CONTAINS DETAILED DESCRIPTIONS AND FINEST ILLUSTRATION OF LARGE NUMBER OF BEST KITS IN EXISTENCE AND QUOTES LOWEST PRICES—Lists Full Line of Radio Parts and Accessories—Explains Our Fair, Easy, Liberal, Golden-Rule Plan of Doing Business. You Need It. Send Coupon or letter NOW.

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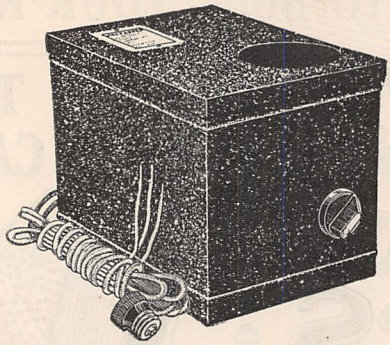

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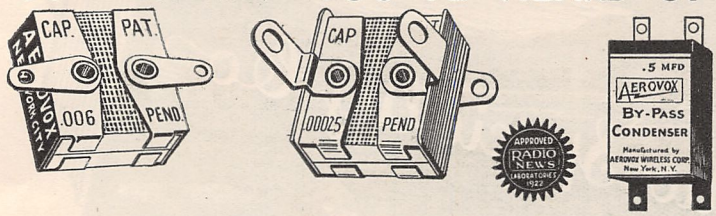

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was confirmed and other data on heat radiation published, *Electrical World*, January 13, 1894. Another piece of work was the design and construction of a standard electrostatic voltmeter. In all these investigations, with the exception of that on the multiplex reasonant telegraph system and the filament galvanometer, much, in some cases most, of the work was done by the students themselves, and it was good, accurate work.

We had a famous football team at Purdue at that time which had defeated Chicago, Michigan and all the other western teams, and it fell to my lot to look after

"Those who in the palaestra did toil
Filled with hard lumps of dough."

in the faculty meetings and to see that that team was not weakened by any of the men falling behind in their studies and getting too many conditions to be allowed to play, and perhaps more ingenuity was exercised in keeping the team in shape than in the electrical laboratory, for the rules were strict and definite, no man who failed in his class work could stay on the team, and if he fell behind special coaching must be arranged for and professors must be persuaded as to the advisability of additional examinations, etc. No one was prouder of the team than President Smart, but from his position and convictions he had to act as "advocatus diaboli." Yet we never disagreed, for he was very just. He took his position, that the men must qualify in their class work, but would not insist on the letter of the law if the work was done, somehow and in time. I grew to like and esteem him very much.

COLUMBIAN EXPOSITION OF 1893

Westinghouse had obtained the contract for lighting the Columbian Exposition at Chicago, but could not use platinum wire for the seals of his incandescent lamps, on account of patents. The invention previously referred to, of silicon iron and iron nickel alloys for sealing in wires had been tested and had proved that such seals could be made and would remain air-tight. But another plan had been proposed, to make the incandescent lamps with stoppers, so that the stoppers could be removed and the filaments renewed so the whole bulb would not be wasted when the lamp burnt out. This was combined with the iron alloy leading-in wires by casting the stoppers around them and the arrangement worked sufficiently well to save the contract, though the stoppers were later abandoned. After the Exposition opened a letter was received from Dr. Holland, Chancellor of the University of Pittsburgh (then called the Western University of Pennsylvania), saying that "Mr. Westinghouse had informed him that he had a particular regard for me and wished, if possible, that I should be offered the newly created chair of Electrical Engineering at the University." A little later a letter was received from Mr. Westinghouse enclosing a check for $1,000 and stating that he wished to take up the gas secondary incandescent lamp if I should be offered and accept the chair at Pittsburgh. It seemed rather difficult to leave Purdue, especially after the electrical students had sent a committee to the trustees to ask them to ensure my remaining, and after the trustees had offered to do anything they could if I would stay, but the advantages, as regards experimental work, of being near and connected with the Westinghouse works were so great that Dr. Holland's offer was accepted.

On the way to Pittsburgh a stop was made at Chicago, where there was an international convention of electricians in connection with the Exposition and where I had the pleasure of meeting Helmholtz, then quite old and apparently a little bewildered by the large scale power installations, Preece, Mascart, Rowland and others, and of being appointed with Preece, Siemens and Kennelly, on the committee on

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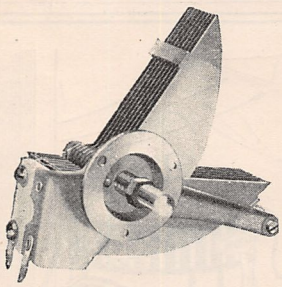

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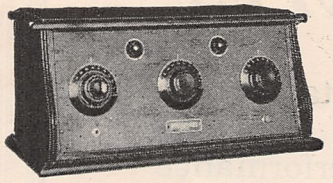

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standards of electrical resistance. The Exposition itself was the most beautiful I have ever seen.

UNIVERSITY OF PITTSBURGH AND ALLEGHENY OBSERVATORY

On one side of the University was the Allegheney Observatory where, thanks to the financial support of Mr. William Thaw, Langley had made his famous measurements on radiation and his still more famous experiments which demonstrated for the first time, and contrary to the accepted scientific doctrine, that it was possible for man to fly. The observatory itself was small and the atmosphere very smoky; the telescope only 13 inches in diameter and yellowish glass; disadvantages which turned Langley to these other lines. Very, his skilled assistant, was still there, who had helped him in the construction of the bolometer and in the measurements.

The flying tests were made by mounting small, thin, flat, or curved pieces of wood of various shapes on long arms rotating on top of a post, and measuring by very ingenious devices their lift and drag at different speeds. Langley found that the lift was much greater than had previously been calculated, owing to the fact that the inertia of the air had not been taken into account, and became convinced that flying was possible.

Dr. Keeler, who had studied in Germany and was a close friend of Willy Wien's, had succeeded Langley and was occupied mainly in spectroscopic work. He had laid out a plan for mapping the surface of the sun by means of the calcium and other spectroscopic lines but, without sufficient facilities, had turned it over to Hale and was working on the determination, spectroscopically, of the rotation velocity of the different portions of Saturn's rings. If they were solid they sould give one kind of rotational shift of the lines; if made up of small planets they should give a different kind. He proved the latter was the fact, and also measured the rotation of Venus. He was a splendid technical man, and fortunately he did not care much for mathematics, so I had the pleasure of doing most of this kind of work for him. Later he was made director of the Lick Observatory and made another great discovery there, *i.e.*, that substantially all nebula were rotating, which had never been suspected, except by a few, until his discovery.

On the other side of the University were Brashear's optical shops. Brashear was originally a mill foreman who had taken up astronomy and made a small telescope himself. Thaw had encouraged him and arranged for him to work in conjunction with the Observatory. He made the flats and concaves for Rowland of Johns Hopkins University, on which Rowland ruled his famous gratings and later made the great photographic doublets for Wolff with which much good work was done. Though not himself a scientific man, he had a large acquaintance all over the world and a charming manner and told a good story. It was a supreme delight to hear him and Joe Jefferson, the actor, who always stopped with him when in Pittsburgh, together, after the theatre, with Keeler's appreciative face, and Mrs. Brashear's coffee. In these prohibition days it seems queer to think that all that brilliant wit was wet only by coffee, but what we could always get, apparently we never wanted. McDowell was Brashear's chief assistant, a fine optician and mechanic and a great chess player. He taught me how to make optical flats and my first 8-inch flat, correct to one-twentieth wave-length, went on a galvanometer used for some specially accurate work on hysteresis.

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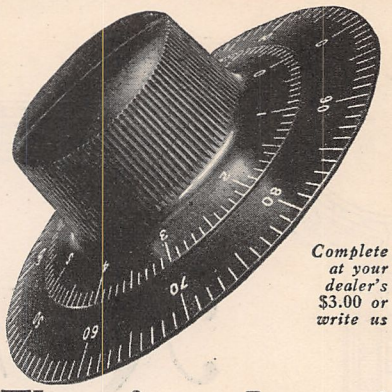

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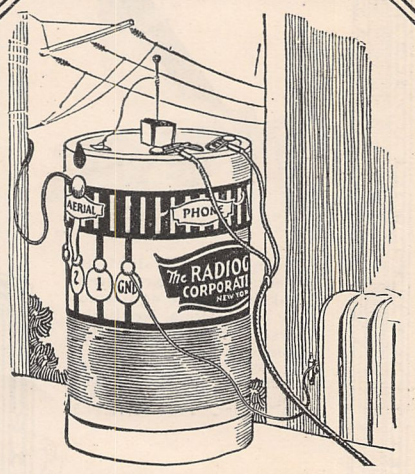

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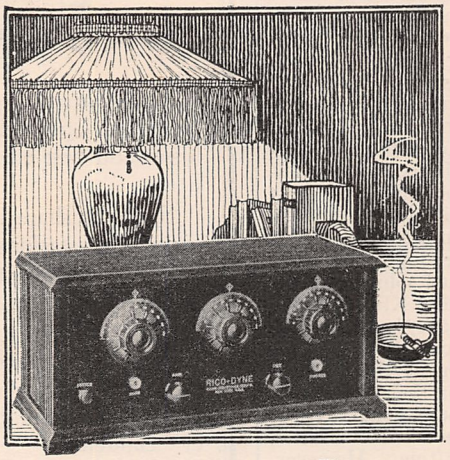

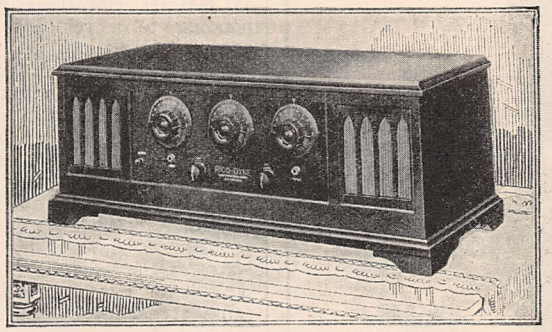

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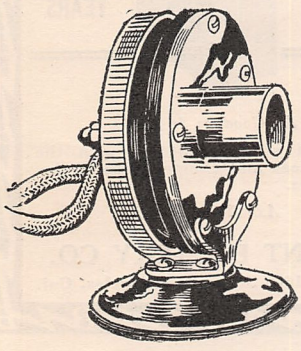

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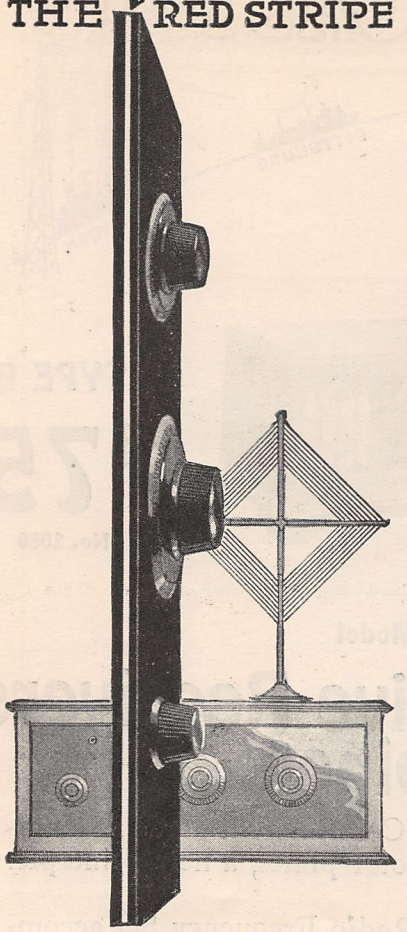

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Plastic Radio by the Kluth System

(*Continued from page* 601)

ment has much to commend it and has been found to work without any hitch, but the setting up of a phase difference has proved to be utterly unable to convey an impression of plastic hearing. The following instance will serve to make this clear:

If the transmitter be operated, say, on a 500-meter wave there would be as much as 600,000 vibrations per second, corresponding to a relatively small number of accoustic vibrations, so that each high frequency vibration would carry only a minute portion of a sound vibration. The arrangement above described will accordingly enable a sound vibration to be shifted at most by a few thousandths of its length.

This failure to obtain an adequate phase-shifting by acting on the high frequency current leads up to the actual solution of the problem as devised by Mr. Kluth, *i.e.*, a *phase displacement in the telephone current.* Telephone currents, of course, have the same frequency as the sounds they set up in a telephone receiver; for the note A, for instance, it is 435. This sound could accordingly be shifted through one half vibration by a 180-degree phase shifting. However, a shifting of about 100 degrees is quite sufficient to obtain an impression of plastic hearing. The accoustic vibration corresponding to note A is about 29½ inches in length and a sound coming, say, from the left would have to travel through a distance about 8¼ inches longer (corresponding to the mutual distance of the two ears) from the left ear to the right, thus undergoing a lag of 21/75 vibrations. Inasmuch as a wave-length of 29½ inches corresponds to a phase displacement by 360 degrees a 8¼-inch lag would correspond to a 100-degree phase displacement. If on the phase of the telephone current could be impressed a lag of about 100 degrees, this deferred current being supplied to the second headphone, the impression of a plastic accoustic picture would be produced by artificial means.

USE OF SEPARATE INDUCTION CURRENT

As regards, next, the means to be adopted in producing a phase displacement in a low frequency current constituting a telephone current, the most obvious would be the insertion of a resistance. This, though reducing the current intensity, would, however, be unable to act on the rate of current flow. If, on the other hand, so far from altering the original telephone current, means were devised for setting up a separate induction current for the second telephone, an approach to the ideal solution could be obtained, while a fully satisfactory solution will be found to result from a very simple additional arrangement. A transformer traversed in its secondary winding by the same current as in the primary winding could be used in this connection, though a more suitable alternative is the use of a combination of two electromagnets between which a membrane is free to vibrate (Fig. 3). As the current in magnet A is growing, membrane M will be attracted and the current in the coil of electromagnet B will decrease. On the other hand, when the current in A is decreasing, membrane M will come close to electromagnet B, causing the current in the latter to augment. In fact, a pulsating current of the same rhythm as the original telephone current, though with a phase displacement of about 180 degrees, is thus produced in electromagnet B. If now the current passing through A is listened to through one head-phone and the current generated in B through the other head-phone, there will still be an impression of

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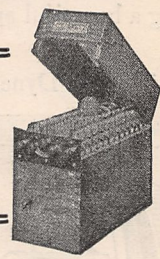

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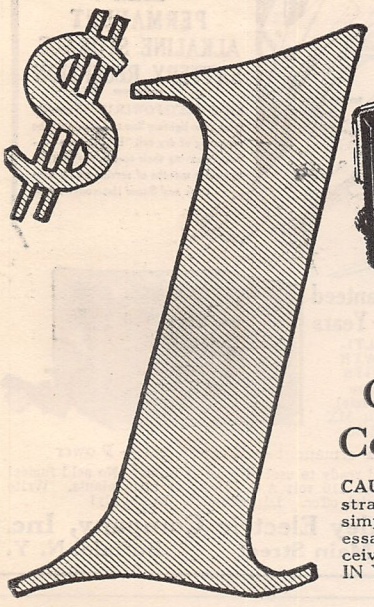

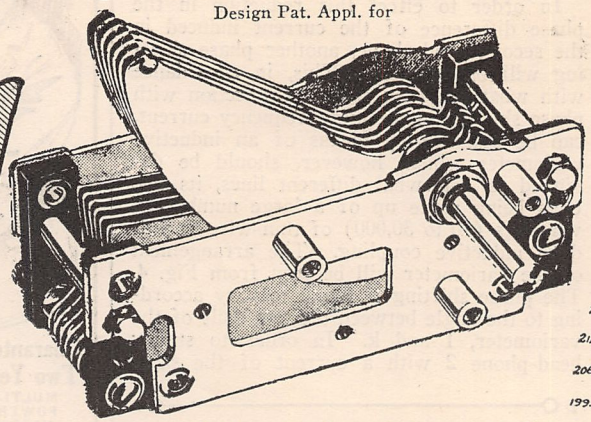

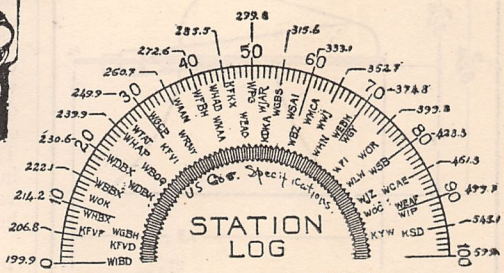

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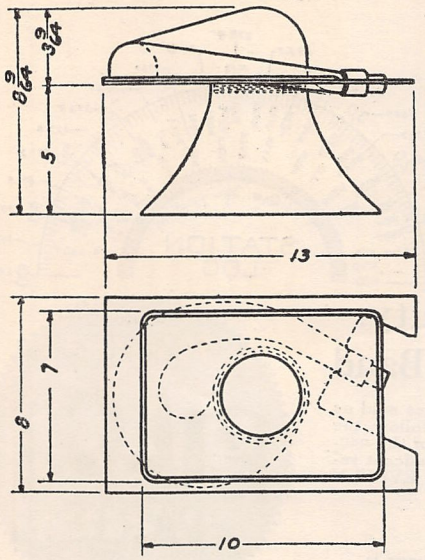

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practically one-eared hearing, a phase difference of 180 degrees being too great to produce the phenomenon of plastic hearing, while a phase displacement of only 100 degrees, in accordance with the above, is quite sufficient to produce it.

In order to effect this reduction in the phase difference of the current induced in the second head-phone, another phase shifting will be required. This, in accordance with what has been said in connection with phase shifting in the high frequency current, can be obtained by means of an inductive variometer which, however, should be designed on somewhat different lines, its two coils being made up of a large number of windings (10 to 30,000) of thin wire to produce inductive coupling. The arrangement of the variometer will be seen from Fig. 4. The phase shifting is found to vary according to the angle between the two coils of the variometer, l and k. In order to supply head-phone 2 with a current of the same

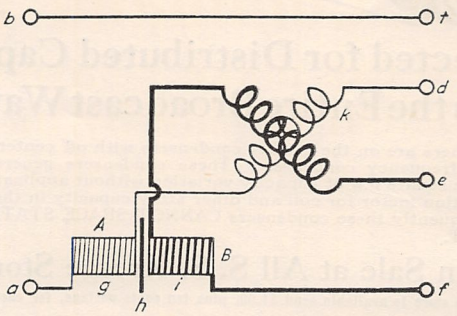

Fig. 4. Circuit diagram of the stereophone as developed by Dr. Kluth is shown above.

intensity as the current operating in head-phone 1, the coils i and l must be devised in accordance. This arrangement will result in a phase displacement of the current in head-phone 2 of just sufficient magnitude to convey the impression of a plastic acoustic picture when listening-in with both head-phones simultaneously. This effect will be further increased by acoustic differences unavoidably connected with the inductive reduction of the current in head-phone 2.

This arrangement thus gives rise to an effect similar to the stereoscope in optics and, therefore, has been fitly styled the stereophone. It is readily accommodated in a small box, only the contacts a, b, c, d, e, f, required to obtain a connection with the radio receiver (a and b) and the two head-phones (c, d and e, f, respectively), being disengaged. The coils l and k are rigidly mounted at a suitable angle to one another.

This stereophone at the present time is the most suitable and straight-forward solution of three-dimension broadcasting, entailing, as it does, no alteration of the transmitter and receiver.

Sound Photographs and Their Reproduction

(*Continued from page* 615)

vice seemingly promised success, but it was soon found that comparatively small currents such as are often encountered in telephone work burnt out the filament, which had to be exceedingly thin so as to respond to the rapid variations of current and translate them into terms of light intensity.

It was found, also, that even with the greatest precautions and the thinnest possible filament the record was not what it should be. The filament was too slow. This caused other means to be sought.

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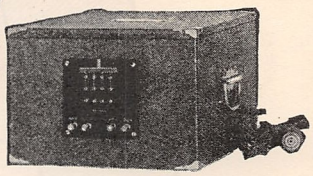

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I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

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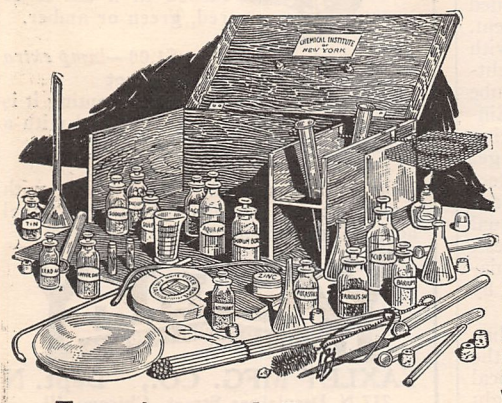
I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.



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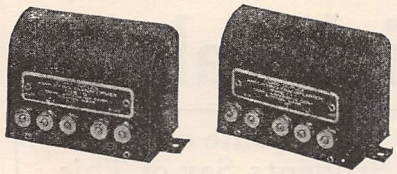

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inventor, Ernst Ruhmer. Ruhmer claims much credit for the invention of the so-called talking electric arc, and gave many lectures and experiments with these arcs. He reasoned that if an electric arc can be caused to talk or to give musical recitations, its light should vary in intensity in accordance with the sound waves. Accordingly, he photographed such an arc through a narrow slit, and actually obtained a sound record, which he reproduced publicly by means of selenium cells.

From an arc in the open air to an arc in an enclosed glass vessel, with low pressure gas as desired, was but a very small step. In fact, shortly after the experiments by Ruhmer, Prof. Korn, of telephotographic fame, the first inventor to transmit pictures of great perfection over great distances by photo-electric methods, proposed to use as light source a Geissler tube, in which the current, and therefore the luminosity, was controlled by an electrically controlled spark gap. He, however, abandoned the scheme in favor of mechanically controlled light regulators, because none of the modern appliances like amplifiers, etc., were at his disposal.

Some form of gaseous tube was almost unanimously decided upon after investigations on this subject were published by Dr. Gehrke of Berlin. Much of the information given by Gehrke on this subject is given in his treatise, "The Negative Glowlight" (*"Das Negative Glimmlicht"*). He describes therein a specific form of tube, which is used quite extensively in Germany and serves as an oscillograph tube, and which will be described in detail. This tube is almost unknown in the United States, and almost never mentioned in the literature of the English language, except in the case of Fleming's work. In analyzing this type of light source, it becomes apparent at once that it should be possible to utilize this tube for the recording of electrical phenomena of extremely short duration and especially of microphone or sound currents.

This glowlight can now be utilized in two distinct ways. In fact, the mechanical recording can also be done in the same distinctly different manner.

The first and, I would say, the easiest method is to vary the light intensity in the tube, so that the impressions on the film are of varying strength. This was, for instance, the only possible way with the modulated filament: all that could be recorded was the varying brightness of that filament. We can, of course, do the same thing with the luminous gas, which increases in brightness as the potential across the Geissler tube is increased, and *vice versa*. With an Einthoven galvanometer in which the string functions more or less like a shutter we get the same sort of record, which is characterized by the fact that the sound waves are represented by a succession of lines of equal length, but varying intensity, or blackness. A record made this way looks like a miniature step-ladder, and is often designated by that name.

The other type of record is obtained when we try not to change the intensity of the light source, but its length, or by mechanical appliances the amount of reflected light reaching the film. It will be seen that if we do but succeed in having the length of the light source vary in accordance with the applied potentials or the amount of current passing, the record will then assume the shape of a kind of very irregular saw with teeth that vary in length constantly. Because the light intensity is kept constant, there is no variation in the blackness of the record. This kind of record is often indicated as the saw-tooth type of record.

A COMPARISON OF METHODS

We shall now try to determine which one of the two kinds of records is the most valuable, and why.

The author has always characterized the

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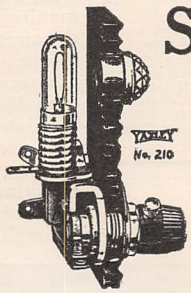

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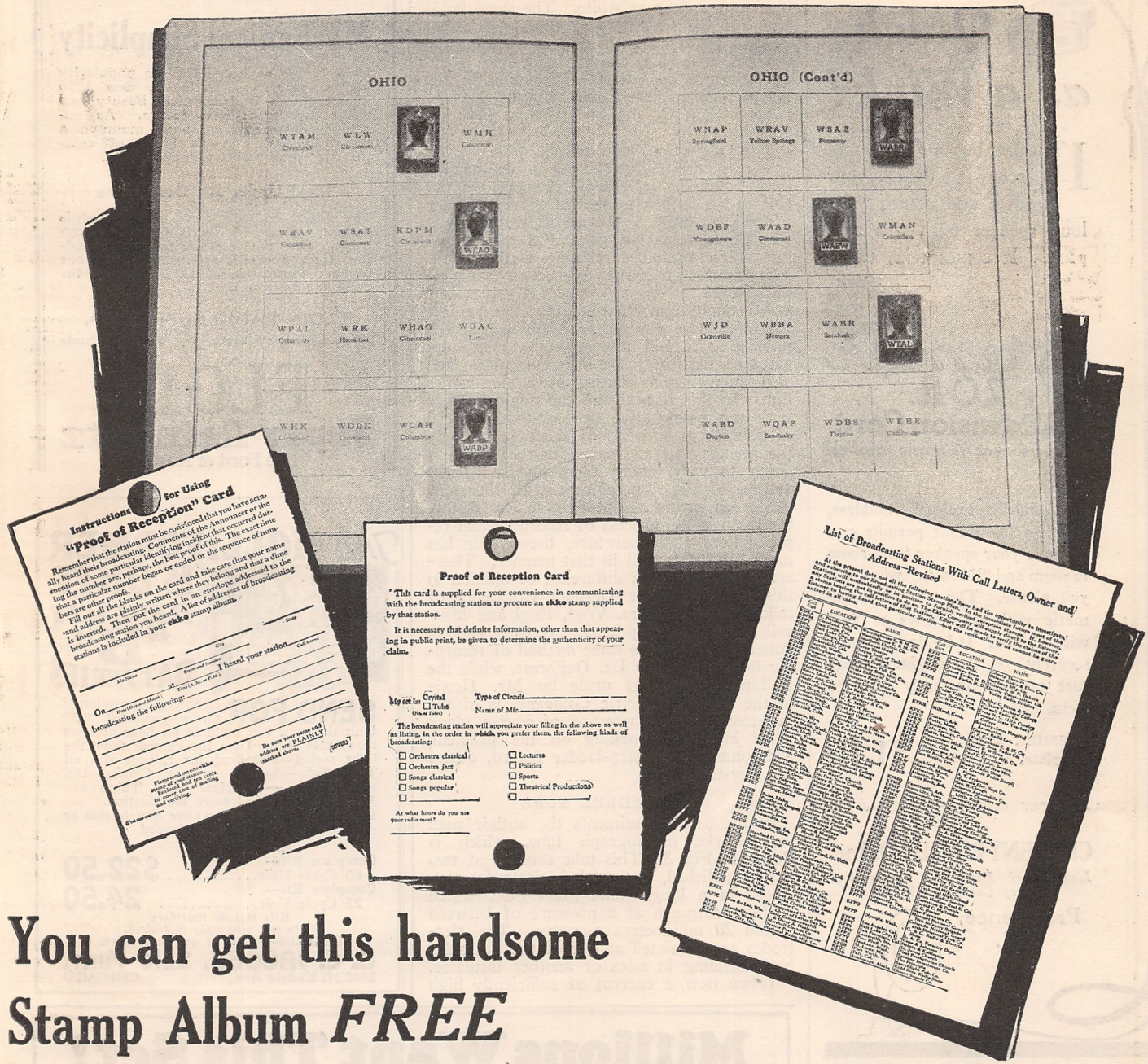
The New Radio Stamp Fad

Here is the DX Radio Stamp Album just like the ones we owned in our youth, in which were placed the rare stamps of the countries of the world. Some were hard to get, some couldn't be purchased for love or money; but the fun of the hobby was the seeking of rare stamps and the eventual possession. So it will be with the DX Radio Stamp Album. There will probably be some stamps you will never be able to own, but there will be many you will be proud to have and be able to show to other radio enthusiasts. It's an interesting game. Below the Album is shown the "Proof of Reception Cards" of which a generous supply is furnished with each Album. A dime placed in the hole in the card and sent to the station you heard brings back a stamp for your Album.



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The album consists of 96 pages, size 9 x 12 and is bound in extra heavy stiff cover.

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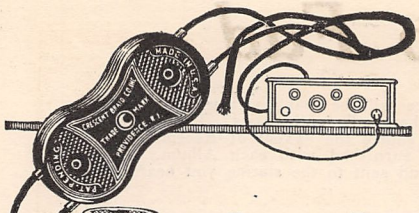

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two kinds of records as the qualitative (step-ladder type) and the quantitative (saw-tooth type) methods of recording, and is in favor of the latter, for the following reasons:

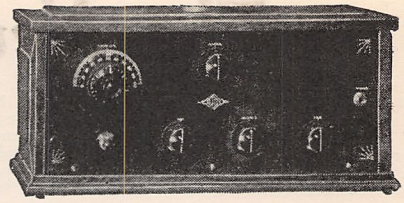
As is generally known, the photographic film is not equally sensitive to different colors. Red, for instance, appears mostly as black in a photograph, as does yellow, while blue may appear as white. The same holds true for the sensitivity of film to different light intensities: in other words, in using the qualitative method of recording one is apt to introduce considerable distortion in the record due to the failure of the film to record faithfully the variations in light intensity.

This distortion, due to the film, is, of course, completely prevented in the quantitative method. It, therefore, seemed desirable to the author to discard the step-ladder method completely. It is, of course, quite possible to correct a good deal of the distortion by special developing methods, but it is apparent that such correction is not at all certain.

An equally important consideration against the qualitative record seems to be that the photo-electric cell also shows varying degrees of sensitivity for different colors, and also intensities as caused by a step-ladder film. In this respect one can again be sure with the quantitative or saw-tooth record of a uniform intensity of the light, as only the quantity of the same kind of light is going to vary, under the influence of the motion of the film. In general, then, the saw-tooth record is apt to give less distortion both in the process of recording and reproduction, and, therefore, the author has made his records all in that manner. There seems to be quite a difference of opinion in this matter, as the German exponents of talking films, Messrs. Vogt, Engl and Massolle, use the step-ladder record, and in America exactly the same method of recording is advocated by Dr. DeForest, while the Pallophotophone, as made by Mr. Hoxie of the General Electric Company, is of the saw-tooth type. There are, of course, many more inventors working on the problem, and some use the step-ladder record, others the saw-tooth type.

THE GEHRKE TUBE

In his own experiments the author used the Gehrke oscillograph tube, which is shown in Fig. 3. This tube consists of two highly polished, flat, nickel electrodes, enclosed in a longitudinal glass tube, which contains nitrogen at a pressure of between 9 and 20 millimeters mercury. The electrodes are insulated at one of the flat sides by imbedding in mica or another insulator. When now a current of sufficiently high



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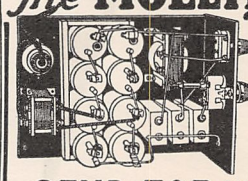

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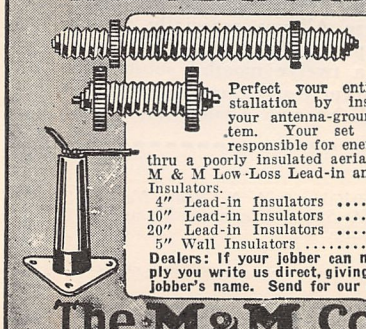

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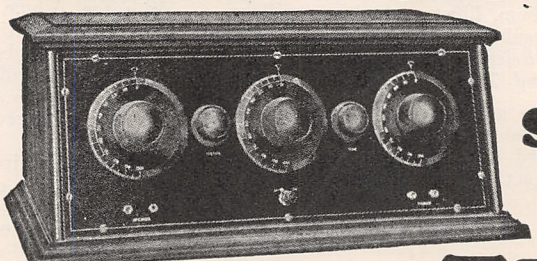

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potential is flowing through this tube, a layer of bluish and highly actinic light appears on the negative electrode. Nitrogen is chosen only for its actinic properties—its glowlight photographs very easily. This layer of light is called the negative glowlight, and careful measurements have shown that its length is proportional to the amount of current flowing through the tube.

When an alternating current is applied to the tube electrodes, the light appears alternately upon one or the other of the electrodes, and a very typical characteristic of it is the fact that the higher the frequency, the sharper is the definition of the light. If one now looks at this light end on or, rather, across the flat electrodes, it will be seen that only a sharply defined line of light becomes visible. And if the alternating current is of radio frequency and is being modulated, the length of this line will vary according to the modulations.

And if one photographs this light through a narrow slit, adapted to the number of frequencies to be accommodated at a given speed of the film, a record results that looks like the films used as border of one of these pages.

The particular pieces of film shown represent the sound waves created by a violin and piano together. As the matter has been presented here it should be clear that the whole process of recording is really a duplication of the processes involved in broadcasting, with the exception of the fact that the modulated oscillations are used to excitate the Gehrke tube instead of being radiated into space.

And it will also be clear that any improvement in broadcasting implements will mean an equivalent improvement in the quality of the sound photograph attainable—not only with the method described herein, but with any and all of the sound recording devices that may be pressed into service.

One of the most important points is, for example, the microphone, used for the conversion of sound waves into electrical energy. Here the choice lies between several kinds: the carbon button microphone, the electro-dynamic microphone, the glowlight microphone of Dr. Thomas of the Westinghouse Corporation, the capacitive microphone, the flame microphone of Dr. DeForest and, about the best of all, the cathodeophone of Messrs. Vogt, Engl and Massolle, and perhaps some other kinds of microphones as yet not published. In an article subsequent to this series the author hopes to deal with the relative merits and demerits of different microphones.

A second question that vitally affects quality in recording and reproducing is the amplification necessary in both these processes. Of course, here every indication of progress in the broadcast studio means an equivalent improvement in the musical film, just as all improvements in loud speaking equipment apply to these sound records. The question might be stated in the following way:

The photographic sound record is but a broadcast performance made permanent, with all the good characteristics possible in broadcasting, except for the fact that static is completely absent in musical films.

Of course, the films may or may not be combined with ordinary motion picture films, so as to make talking motion picturees. It is the conviction of the author that the talking motion picture is the coming form of amusement, since for these films the very best talent may be engaged, so that the smallest town may have the benefit of metropolitan performances. But—to be a success the talking movies must outgrow their inherent faults. Before the public will accept them perfection must have been attained. For this reason the author has never even entertained the thought of exhibiting his films in public—as he had no wish whatsoever to assist the opposition to talking

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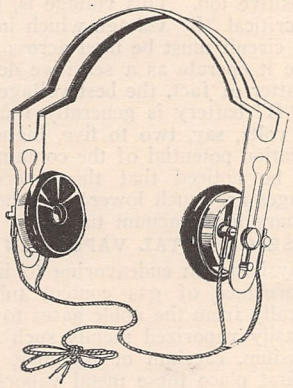

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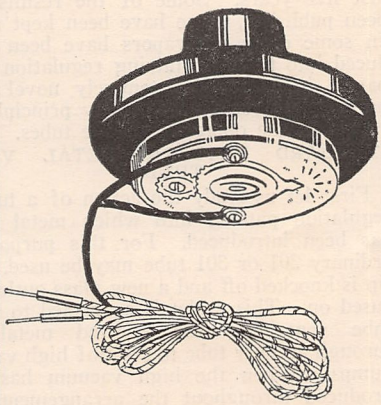

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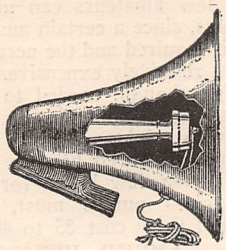

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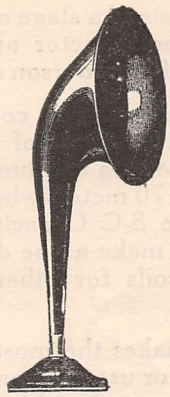

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movies. Because one thing is sure: the talking or musical motion picture film will come into its own only after a severe and bitter fight with the powers that be in filmland, and the one who wants to be successful in this controversy must be sure of technical perfection of his system.

Hot Cathode Metal Vapor Tubes

(*Continued from page* 604)

a positive ion. This voltage is, presumably, the critical "B" voltage which in a detector tube circuit must be used across the tube to make it operate as a sensitive detector. As a matter of fact, the best voltage to use for the "B" battery is generally found to be a few volts, say, two to five, higher than the ionization potential of the contained gas. It will be noticed that these necessary "B" voltages are much lower than those used on ordinary high vacuum tubes.

USE OF METAL VAPORS IN TUBES

Physicists, in endeavoring to improve the performance of gas content tubes, turned naturally from the noble gases to the vapors of easily vaporized metals such as sodium, potassium, caesium or mercury, because in the first place these metal vapors are monatomic, in the second place they are not absorbed on glass or on metal as extensively or as irregularly as are gases, and in the third place they have very low ionization voltages, in some cases well below five volts.

Without doubt every laboratory interested in the production of vacuum tubes has experimented more or less extensively with these metals as fillers for tubes during the last five years. Some of the results have been published, some have been kept secret. In some cases the vapors have been introduced into tubes containing regulation metal parts; in other cases entirely novel metal parts have been used and new principles involved in the operation of the tubes.

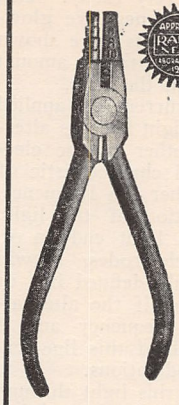
STANDARD PATTERN METAL VAPOR TUBES

First let us study the action of a tube of regulation pattern into which metal vapor has been introduced. For this purpose an ordinary 201 or 301 tube may be used. The tip is knocked off and a new glass outlet tube fused on. This outlet is connected to a side tube containing the selected metal and through another tube to a set of high vacuum pumps. When the high vacuum has been produced throughout the arrangement (the filament having been glowed and all glass parts well heated to drive out air and water vapor) a drop of liquid metal is allowed to run into the three-electrode tube, which is then sealed off. The tube can now be used like any ordinary tube in a receiving set, but its characteristics will be much altered, as we shall see in a moment. Fig. 1 shows the apparatus needed for this work. It is apparent that few amateurs can undertake such experiments, since a certain amount of glass-blowing is required and the necessary vacuum pumps are relatively expensive. The amount of practice, though, needed to constrict and seal off straight glass tubing and to seal together two straight pieces of tubing, which is all that is required here, is less than one would think—a few hours for a few days. Suitable glass pumps must, however, be bought, and these cost 35 to 40 dollars.

LIQUID METALS

For maximum ease in loading the tubes with metal a liquid metal should be used. This requirement limits us to two possibilities; one, mercury and, two, sodium-potassium alloy, both of which are more suitable liquids. Of these the alloy is the more suitable for our present purpose since its ionization voltage is less than four volts, whereas the ionization voltage of mercury is about 10.5 volts.

The "Windham" Wire Former



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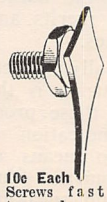

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The sodium-potassium alloy can be prepared by melting together 24 parts of sodium metal and 40 parts of potassium metal. These metals take fire readily and spontaneously in moist air, making a fierce and somewhat explosive fire. The alloy must, therefore, be made up in a tube from which the air has been exhausted. The more water put on such a potassium fire the harder it burns, since the water is decomposed by the metal, liberating hydrogen, which is ignited by the heat of the reaction. *These metals should be handled only with the greatest precautions.* For these reasons I do not recommend such experiments to those without full laboratory equipment.

After the tube has been prepared in the way described it can be put into use in an ordinary receiving set. The lighted filament warms the tube up considerably, vaporizing some of the alloy and increasing the density of the vapor made up of sodium atoms and potassium atoms which occupies the bulb. After a definite operating temperature has been reached the density of this vapor remains fixed; that is, the number of metal atoms in each cubic centimeter remains fixed. The electrons from the filament are drawn over through the grid to the plate by the combined influence of the plate and grid voltages—the effective voltage pulling the electrons varying with the potential of the grid of the plate voltage is constant. Before the electrons falling through this voltage drop acquire a certain minimum energy—the ionizing energy—they bounce off such metal atoms as they may strike without affecting them in any way. After the critical ionization energy has been reached by the electron it will knock apart any atom it hits. As has already been pointed out, this ionizing action explains how high plate current values are reached in these tubes—at lower voltages than in high vacuum tubes.

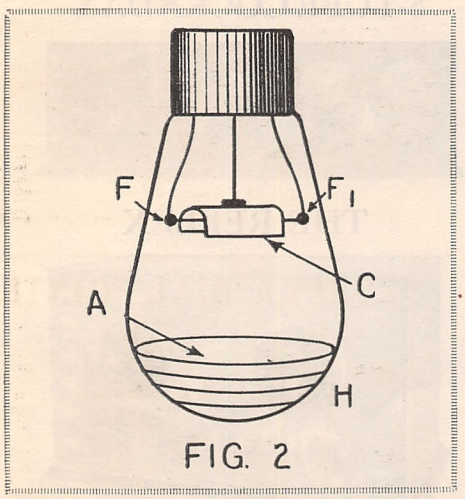


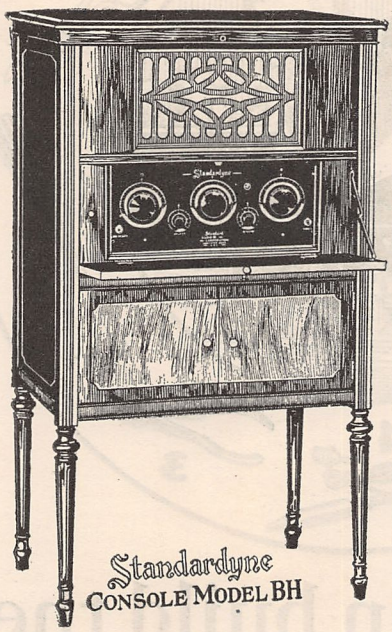
FIG. 2

A is sodium metal, and on the outside of the tube is H, a heater coil. FF_1, the filament and C, a collector plate.

Instead of entering into a scientific description of the characteristics of tubes made with sodium-potassium alloy I shall merely give certain facts taken from actual tests. Such tubes are found to be excellent detectors, showing in use a sensitivity three to four times as high as first-class gas-filled tubes operated under the best conditions. They are not critical in adjustment as to applied voltage and the best results are obtained at plate voltages of only ten volts. They give satisfactory service when used in a grid leak arrangement with 0.0003 microfarads and a 2-megohm leak. They have fairly long life and are stable.

Tubes of this kind also amplify well, introducing no distortion, and can be used in amplifier circuits, giving results on a ten-volt battery equal to those of hard amplifier tubes on 45 or 90 volts. It seems, consequently, that the use of the alloy results in

Standardyne



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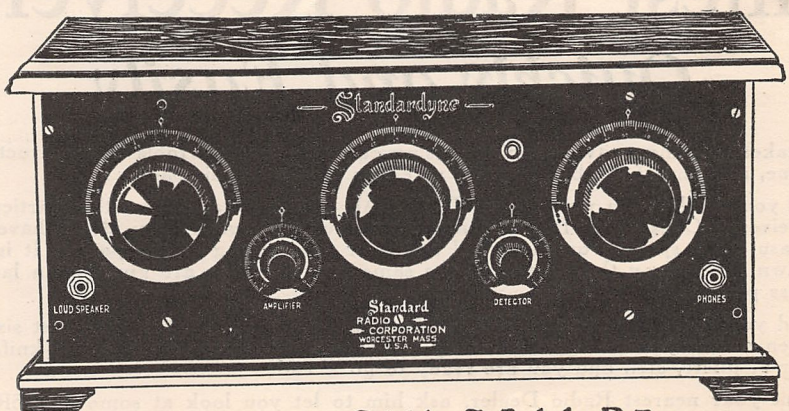

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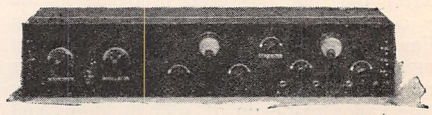

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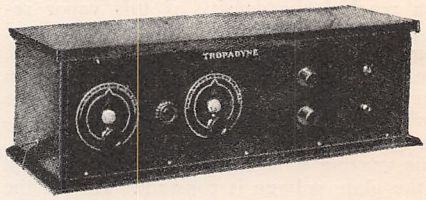

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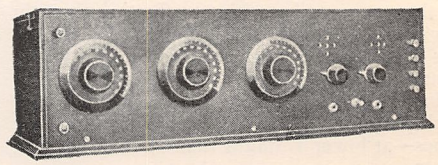

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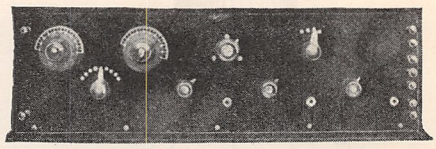

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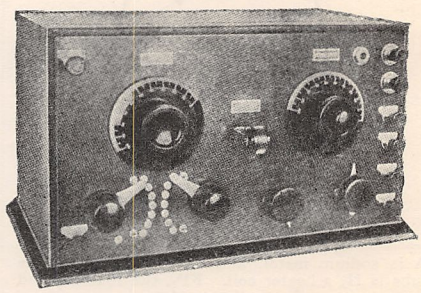

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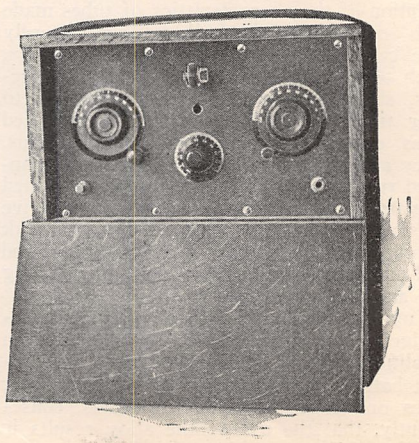


a distinct improvement in all respects. Of course, such tubes, when used in a regenerative circuit, will oscillate and produce reradiation disturbances, but in this respect they are no worse than the ordinary radio tubes. Considering these tubes from the commercial standpoint it must be said, however, that their manufacture involves an expensive and somewhat dangerous operation beyond the completion point of ordinary tubes. The advantages of these tubes, which have been known for two years past, due largely to the work of Professor Knipp and Mr. H. A. Brown of the University of Illinois, would no doubt have been more widely applied except for this feature of extra trouble and expense in manufacture.

SPECIAL METAL VAPOR DETECTOR

Next, let us turn our attention to one of the most unusual of the specially built tubes employing metal vapor. The vapor in this tube is sodium vapor. Sodium is a soft metal, easily scratched with the finger nail, and having a low melting point (about six degrees Fahrenheit below the boiling point of water). Its boiling point is, comparatively, fairly high, about a red heat, so that to get a high vapor pressure of metal in a tube containing sodium it is desirable to use an external heater of some sort. This particular tube has such a heater in the form of a resistance wire cemented to the part of the bulb farthest from the socket end. Fig. 2 shows the general construction of the tube. At A, inside the tube, is the deposit of sodium metal—at H, outside, is the heater coil. The deposit A serves as the plate or anode of the tube and is connected to one of the prongs of the socket. FF¹ is a tungsten filament supported horizontally and connected to two other socket prongs. C is a collector plate, of the form shown, which lies above and partly around the filament and close to it—much closer than the sodium anode, as is seen in the drawing. This collector, which corresponds to the grid of the ordinary tube (although the principle of its operation is quite different) is connected to the fourth prong of the socket.

CIRCUIT CONNECTIONS

When in use as a detector this tube is connected in a circuit like that shown in Fig. 3. It is at once evident that this device is, at any rate superficially, very different from ordinary tubes. Before describing how it

4 Non-Technical Radio Articles

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature.

List of Radio Articles Appearing in the November Issue of "Science and Invention"

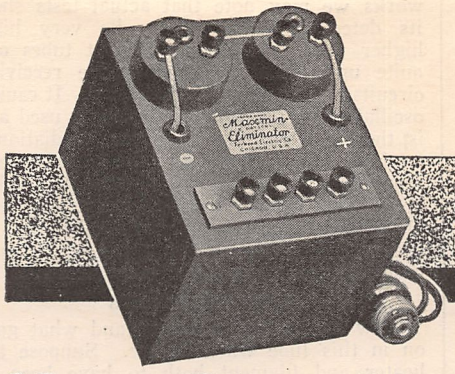
A Continuous Broadcast Service
By C. A. Oldroyd

A Novel Six-In-One Receiver
By L. Ringer

Radio Hazards

Five Tubes But Only One Tuning Control

Hints for the Radio Builder, Part III
By Leon L. Adelman, Assoc, I. R. E.



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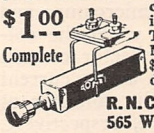

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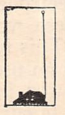

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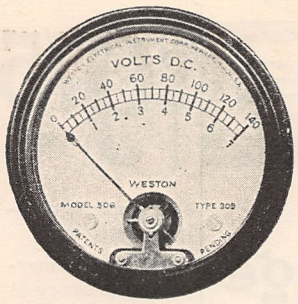

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works we may note that actual tests show its detecting sensitivity to be very high, higher than that of gas content tubes and quite up to that of regenerative receiving circuits on the point of oscillation. It cannot oscillate over the range of voltages used and is, therefore, entirely free from reradiation—an important advantage. The plate voltage required ("B" battery) is about ten volts. It is stable in operation and has a long life. On the other hand, it will not amplify and its use is limited to detection, for which purpose it is seen to be remarkably effective.

HOW IT WORKS

Now let us try to understand what goes on in this tube when in use. Suppose the heater and filament both to have been in action long enough to bring everything up to normal operating temperature. The tube will then be filled with a fairly dense atmosphere of sodium metal atoms. The surface of the sodium deposit, what we shall call the anode, is seen to be kept at all times positive to the filament by the "B" battery; the collector sheath, on the other hand, may be made either positive or negative to the filament by sliding the contact K on the resistance R, which is across the filament battery. If both anode and collector are positive, by far the larger part of the electron discharge will go to the collector, which is much nearer the filament than the anode and, in addition, nearly surrounds it. When the collector is made negative it will check back the electron discharge from the filament by repulsion and will thus reduce the flow both to itself and to the anode, but at different rates. The tests showed in a particular case that when the collector was at —2 volts, the anode being held at +15 volts, the current to the collector was 100 microamps and to the anode 50 microamps; when the collector was at —1 volt the collector current was 1,000 microamps and the anode current 225 microamps, while with the collector at —0.2 volts the currents were, respectively, 1,400 microamps and 340 microamps. It is to be remarked here that the collector current was always about four times as great as the anode current—a striking point of difference, compared to the regular three-electrode tube, where the grid current at these voltages would be negligibly small.

This feature explains why the sodium tube is of no use as an amplifier—it takes too much power in its input circuit. When the complete curve is drawn, showing how the anode

The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER has come back BIGGER AND BETTER THAN EVER.

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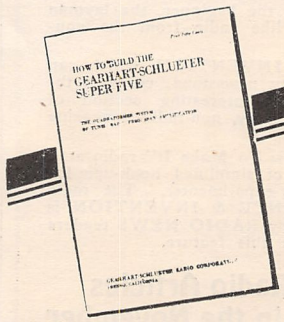
LIST OF INTERESTING ARTICLES TO APPEAR IN THE NOVEMBER ISSUE OF THE EXPERIMENTER

How to Make the Electro Mystic Crystal Globe. By Phillippe A. Judd.
Electrified Butterfly Lives 25 Years. By B. Vincent, Southampton, England.
Evolution of the Vacuum Tube. By Leon L. Adelman, A. M. I. R. E.
The Luludyne. By Simon Kahn, 2CGX.
Testing Insulating Materials.
Liquid Hydrogen.
Transmiting Photographs By Cable.

The EXPERIMENTER will be on sale at all newsstands November 20, 1925.



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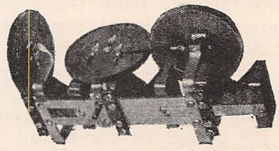

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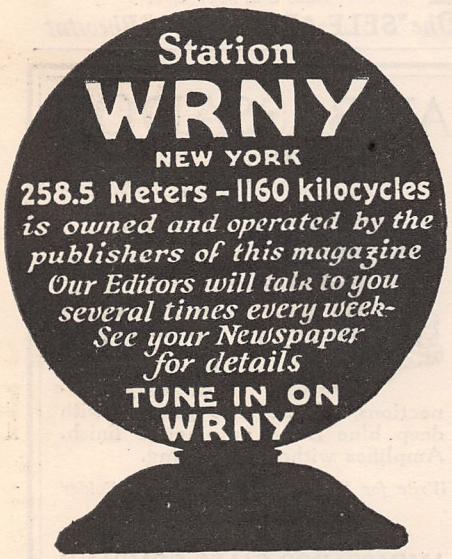
current changes with the collector voltage, there is found to be in it a definite "elbow" (Fig. 4) at a certain voltage value of the collector; in the case shown, when the collector is at —1.5 volts. This elbow means, as is seen from the figure, that an increase of one-tenth of a volt in the collector potential increases the anode current only one unit, while a decrease of one-tenth of a volt decreases the anode current three units.

When the collector is set at this particular voltage and a radio wave is received by the circuit the collector potential fluctuates up and down across the set value (—1.5 in this case) and the plate current is caused thereby to fluctuate in a similar manner, but symmetrically, up one unit and down three for each radio wave that comes in (B, Fig. 5). The net result of a whole train of waves (A, Fig. 5), such as constitutes, say, a dot or dash of a code signal, will be a depression of the anode current (C, Fig. 5), which will cause a click in the telephones when it starts and another when it stops. It is in this way that the tube operates as a detector. This explanation of reception through partial rectification of the radio wave impulses at an elbow of the plate current curve is of general application to any simple detector which does not employ a grid leak and condenser connection.

ADVANTAGES OF THESE TUBES

To use the sodium tube in the detector



circuit of Fig. 3 it is evidently necessary to set the slider K so that the collector potential has the proper value. In practice, however, this adjustment is not found to be critical nor does the tube tend to drift out of adjustment, once its operating temperature has been reached. This brief description serves to show that the sodium tube represents a distinct improvement on the ordinary three-electrode tube as a detector, that it is steadier than a gas-filled tube and that it is entirely free from the nuisance of reradiation.

The two tubes described in this article not only show that hot filament metal-vapor-filled tubes are of value in their present stage of development, but they also indicate the possibilities of important further improvements along these lines. Similarly important new applications are being made of cold-cathode gas-filled tubes, although these are being applied for the most part to purposes of rectification.

A SCIENTIFIC WONDER

SMITH: I got something good from White's loud speaker last night.

JONES: Good stuff, eh?

SMITH: I should say. White has a pipe running from it to his still in the cellar.

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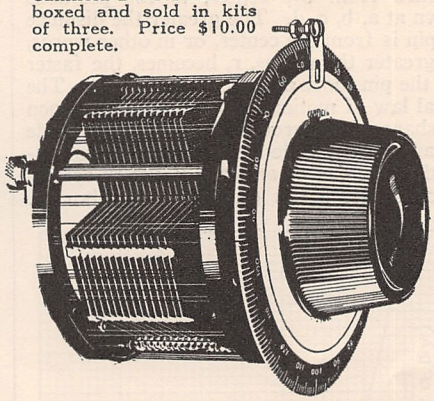

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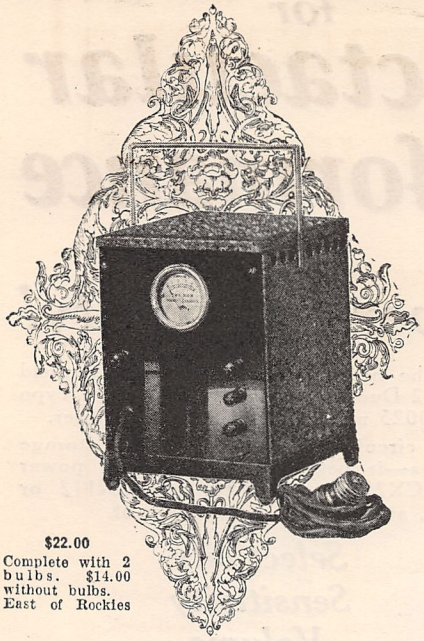

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S. L. F. Dials

(*Continued from page* 619)

movable plates. For instance, suppose a plate, A, which can be rotated about the center, O. This plate has a groove, B, in it, in which travels a pin at the end of an arm, r. The arm, r, has likewise a slot in it, so that the pin can travel up and down the length of the arm.

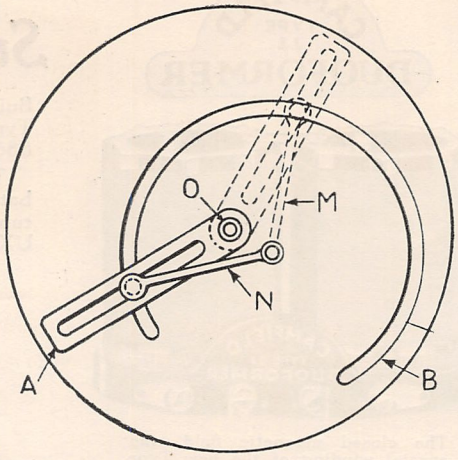
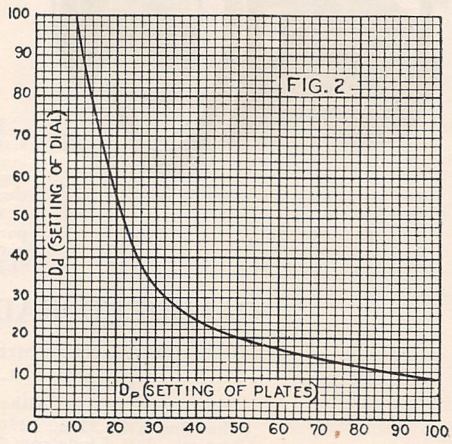


FIG. 3

As the plate, A, is rotated, the pin moves outward from the center, to the positions shown at a, b, c, d. The greater the distance the pin is from the center, or in other words, the greater the radius, r, becomes, the faster will the pin move around the center, O. The actual law of motion of the pin depends upon the shape of the groove, B, and can be made to vary within wide limits. The pin is fastened at the end of an arm, m, which rotates the condenser plates (these are not shown).



The angular setting of the condenser plates varies with the angle of the dial in accordance with the curve above.

Many variations of this principle are possible, as can be seen in the various illustrations on these pages. Sometimes ring-gears and pinions are used, but the design is greatly restricted by these, as the motions are, in turn, restricted by the possible ways of designing gears. The principle represented by Fig. 3 permits of a perfectly linear calibration.

Other ways of constructing variable motion dials employ gears of special design, such as elliptical or hyperbolic shapes. An example of the use of elliptical gears is shown in one of the illustrations. The elliptical gears, however, do not allow linear calibration, but only an approximation to the linear. Hyperbolic gears are difficult to use, because of their tendency to jam, and because they require a lot of room in which to operate. They have not been used as yet in a commercial product.

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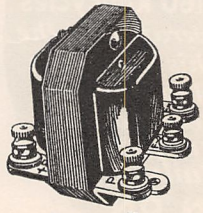

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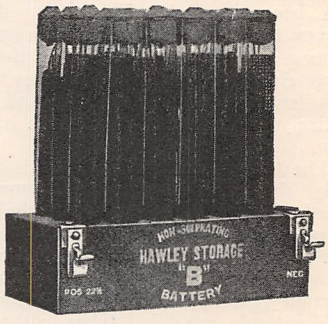

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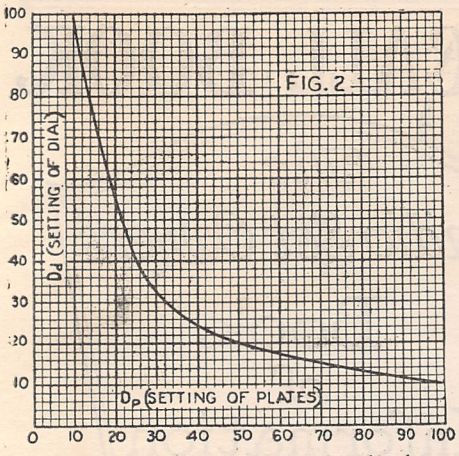

This chart shows the relation between the plate setting and dial setting, as determined from Fig. 1.

Before closing this article, we must not forget the necessity of having the proper minimum capacity in the condenser. The dial should be constructed (if linear calibration is desired) so that the plates of the condenser are partly in mesh when the dial reads zero, so as to furnish the proper minimum capacity. Or, if not designed to take care of the minimum, a small variable condenser should be shunted across the main condenser, adjusted to the proper value, and let alone. If the minimum capacity is not of the proper value, the calibration curve will depart from the linear, as explained in the October issue of RADIO NEWS. This, however, will not interfere materially with our ability to separate the stations when tuning.

WRNY Starts Broadcasting Innovation

(*Continued from page* 599)

is now going forward under the guidance of Mr. Pierre Remington.

Among others who are handling the song repertoire, we can name Gennaro Mario Curci, known as brother-in-law and coach of the famous Amelita Galli-Curci. Every other week Mr. Curci and a group of singers will put on a song recital.

Chevalier de Lancellotti, who holds medals from several European organizations, will head one of the leading song recital groups.

Meta Christensen heads a group which will be heard regularly in quartette music. The Bernstein Trio will also be heard in chamber music. Dr. Sigmund Spaeth, author, composer and lecturer, heads a twice-a-month appearance of noted artists. In his memorandum, Dr. Spaeth says the program will be given entirely by singers, violinists and, cellists who have appeared with the Ampico in public. He will be assisted in the direction by John Tasker Howard.

We will be taken around the world in music by the Volga Trio and by J. Van Cleft Cooper, lecturer and singer.

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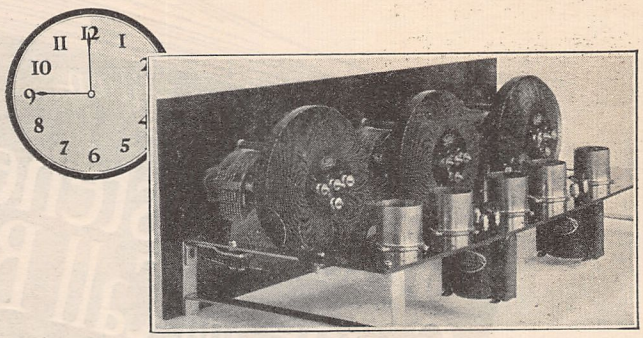

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In the 'cello department are names like Vladimir Dublinsky, Anna Drittel and others.

Mme. Clara Novello Davies will organize a twice-a-month oratorical concert on Sundays. Also in the music department must be mentioned such names as Harriet Seymour, noted as a reader in musical education, and James Gordon Beaver, who will handle all the English ballads, and Inez Barbour, who will handle the American composers. Miss Barbour is Mrs. Henry Hadley in private life, Mr. Hadley being the famous American composer. John Adam Hugo is now at work on an opera especially written for radio for WRNY.

Kathryn Behnke, known as "The Lullaby Lady," and Lorna Lee, "The Love Song Girl," will be two of the station's most popular singers.

In the arts department we are proud to have the name of Alexandre Zeitlin, who will lecture on sculpture, and Celeanor Dugas, who will discuss painting. Miss Dugas is an American portrait painter of considerable merit. One of the features of the station will be an actual exhibit, to which radio fans are invited, of the paintings and sculpture and architecture of the heads of these departments.

Anita Browne, who is head of the Allied Broadcasters, will have the direction of the literary, theatre and fiction departments.

We cannot tell you the whole story in one issue, but if you will follow WRNY you will see what it is we are trying to work out. However, we must give you these facts:

Mrs. Brock Pemberton, wife of the famous theatrical producer, and herself a noted artist, will give a new point of view on the costumes of the theatre.

Resta Crowell will carry us through all of the old plays, the great classics of all time.

There is to be a series on the Kings of Sport, in which the leaders in all fields will appear.

The Society for the Promotion of American Aviation will send men well known in the profession to WRNY each week to give lectures on aeronautics.

Negotiations are now practically completed which will make WRNY programs the most impressive in the entire field.

Not only will the WRNY prospectus tell you far in advance just what you may expect to hear, but the departments will also give you every month a resumé of developments that have taken place in each of the departments.

As the new regime has just got under way, there is nothing much to say except that it was introduced at the Roosevelt Hotel, where its opening was attended by many prominent New Yorkers. Among those present were Otto H. Kahn, Hugo Riesenfeld, Dr. Herbert Goldstein, Ben Bernie, Hon. Bird S. Coler, Hugh Kent, J. Andrew White, Father Finn and Dr. Sigmund Spaeth.

Salt: "How do they determine longitude by radio?"

Op: "They send a signal, see how long it takes to get there—and that gives the long-itude, old son."

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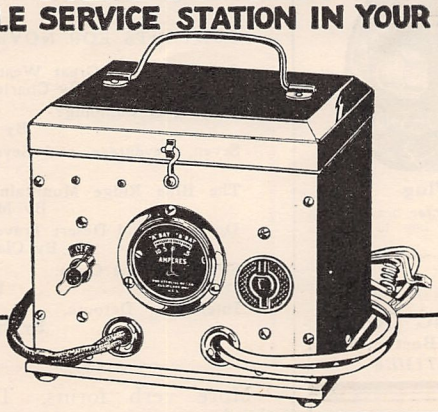

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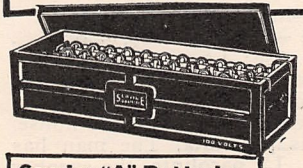

Everybody can now enjoy the benefits of Storage "B" Batteries—more power, quieter reception, greater economy. Rubber case prevents leakage or shorting. Easy to recharge. Will last for years with ordinary care.

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Indestructible rubber case. Two year guarantee.
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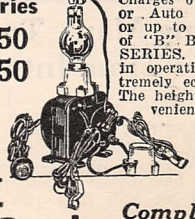
Charges 6-volt "A" or Auto Batteries or up to 125 volts of "B". Battery IN SERIES. Noiseless in operation. Extremely economical. The height of convenience.



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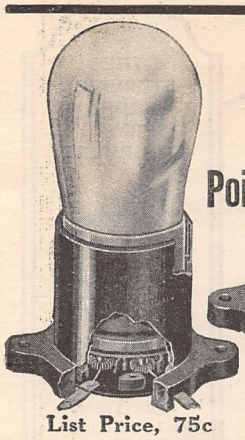

56
Points of Contact

List Price, 50c

List Price, 75c

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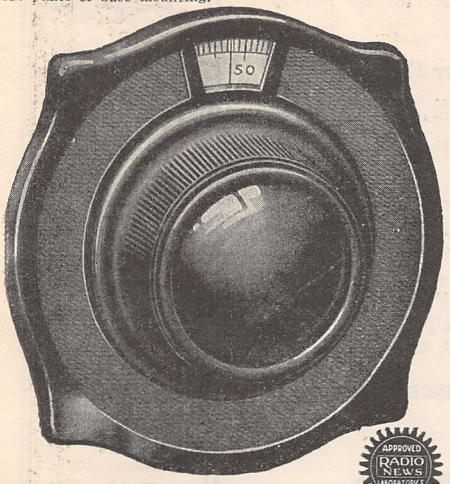
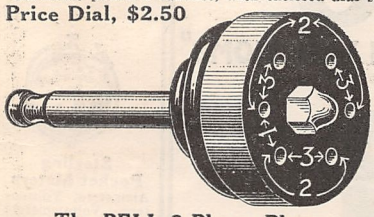
Fourteen points of contact on the **side** of each prong in this new socket. A straight push seats the tube; no twist needed. Tube is supported by contact springs (**not** the socket shell). It "floats" on springs, perfectly shockproof. Suitable for sub-panel or base mounting.



The 2-in-1 Vernier Dial

A sensitive, easily-controlled dial giving coarse or 15 to 1 vernier tuning without lifting the hand from the big knurled knob. Handsome polished bakelite, with enclosed dial scale.

List Price Dial, $2.50



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53 Park Place, New York, N. Y.

Esperanto Broadcast Lessons

(*Continued from page 607*)

denotes a great size or degree, and **—et—** a small size or degree, of that which the root signifies, as **domo,** a house, **domego,** a mansion, **dometo,** a cottage; **ŝnurego,** a rope, **ŝnureto,** a string; **monto,** a mountain, **montego,** a huge mountain, **monteto,** a hill

—il— denotes an instrument by which a thing is done; **razi,** to shave, **razilo,** razor; **butero,** butter, **buterilo,** a churn; **trancî,** to cut, **trancîlo,** a knife.

—an— signifies a **member,** an **inhabitant,** an adherent of a party, religion, etc. **Klubo,** club, **klubano,** a club member; **Londono,** London, **Londonano,** a Londoner; **vilaĝo,** a village, **vilaĝano,** a villager.

The accompanying table of correlative words is an invention of Dr. Zamenhof. If you learn the general significance of each of the nine descriptions at the left side, then the particular meaning indicated by each of the five letters across the top, you will be instant master of the whole forty-five correlative words with no need of the dictionary It is somewhat puzzling at first, but be assured that a little study will reveal its secret of simplicity.

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CONTENTS FOR NOVEMBER ISSUE

A Loop of the Great West,
By Charles L. McCollum.
Touring or Camping?
By James Hawkins.
Seven, Seventeen and Seventy,
By J. A. Bond.
The Blue Ridge Mountains of Virginia,
By Melvin T. Bunch.
Do You Mind Desert Travel?
By Claude P. Fordyce.
Sticking to the Open,
By George Law
Interesting Detours,
By Hattie Mae Hall.

More verb forms. The active participles are:

Present tense end in—**anta,** (adjectival), —**anto,** (substantival), —**ante,** (adverbial);

Past tense —**inta,** —**into,** —**inte;**

Future tense —**onta,** —**onto,** —**onte.**

Examples in use: **La viro estas parolanta.** The man is speaking. **La parolanto,** the speaker. **Parolante, li eniris la domo,** Speaking, he entered the house.

La viro estas parolinta, The man has been speaking. **La parolinto,** the speaker (who has spoken). **Parolinte, li eniris la domon,** Having spoken, he entered the house.

La viro estas parolonta, The man is about to begin speaking. **La parolonto,** The speaker (who is just about to speak, not yet having begun speaking).

The passive participles are:

Present tense end in —**ata** (adjectival), —**ato** (substantival), —**ate** (adverbial).

Past tense —**ita,** —**ito,** —**ite.**

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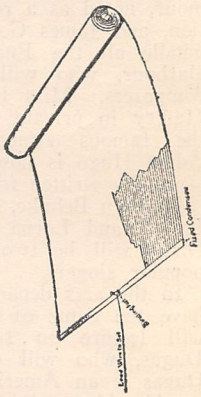

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Future —ota, —oto, —ote.

La poemo estas lernata, The poem is being learned. **La batato,** The person being beaten. **Batate, li kriis,** Being beaten, he cried. **La skribita letero,** The written letter. **Vidite, li forkuris,** Having been seen, he ran away.

All the forms of the Passive Voice are made by the verb **Esti,** to be, and a passive participle of the required verb:

La pordo estas fermata, fermita, fermota, The door is being shut, has been shut, is about to be shut. The preposition used with the Passive is **de,** by: **Mi estas amata de mia patro,** I am (being, present time) loved by my father. **Ili estos sendataj de sia fratino,** They will be sent by their sister.

All participial verbs, being adjectival, take the plural ending **j** when the noun to which they belong is plural, as illustrated in the example above: **"sendataj"** refers to **"ili"** the plural subject.

VOCABULARY

ondo, wave
sen, without
fadeno, wire
rapida, rapid
ordinara, ordinary
pro, on account **of,** because of
efekto, effect
resendi, repeat, **re**send
uzi, to use
longa, long
tial, therefore
utila, useful
ŝipo, ship
sur, upon, on
maro, sea
anteno, antenna
aparato, apparatus, set
logi, to entice, attract
(al-loga, to be enticing, alluring, attractive).
vidi, to see
juna, young
viro, man
fraŭlino, young lady, Miss
aŭskulti, to listen
muziko, music
laŭtparolilo, loudspeaker
fari, to do, to make
sed, but
komenci, to commence
preparo, preparation
por, for, in the interest of
alveni, to arrive
el, out of, from among
ami, to love
okulo, eye
blua, blue
nur, only
ankaŭ, also
granda, large, great
valoro, value
mondo, world
maristo, marine, sailor
promenadi, to promenade, to walk
ferdeko, deck
renkonti, to meet
kelka, some
Nov-Jorko, New York
ofte, new
speco, species
floro, flower
disvolvi, to develop (disvolvigi, to cause to develop).
de, of, by
da, of (referring to quantity only)

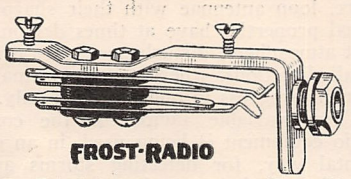
READING EXERCISE

Ondoj de senfadena telegrafo kaj telefono estas pli rapidaj ol ordinara fadena telegrafo pro la malrapidiga efekto de la resendigiloj uzataj en longa telegrafadeno, tial, oni povas diri, fadena telegrafo estas malpli rapida ol senfadena. Senfadena telegrafo estas la plej utila en ŝipoj sur la maro. La malplej utila afero sur ŝipo estus telegrafsendilo sen antenoj kaj aliaj aparatoj. Ju pli oni lernas Esperanton, des pli bela kaj alloga ĝi estas. Sidantaj tie en tiu loko kie neniu povis vidi ilin, la juna viro kaj la fraŭlino aŭskultis al la muziko venanta el la laŭtparolilo. Hieraŭ kaj hodiaŭ mi faris nenion, sed mi estas komenconta preparojn por iri morgaŭ kiam vi alvenas. El siaj fratoj, ŝi amas pli tiun kies okuloj estas bluaj. Ŝi estas nur knabineto sed sia frato ankaŭ treege amas ŝin. La radio estiĝas grandega en sia valoro al la mondo. La senfadena telegrafisto kaj unu el la maristoj de la ŝipo promenadis sur la ferdeko kiam ili renkontis kelkajn Nov-Jorkanojn. La anoj de la klubo estas tre ofte uzintaj la radio-aparaton en la klubdomo. La parolanto sur la radio estas dironta pri tia nova speco da floroj kiujn disvolvigis Burbank.

FROST-RADIO

Ask Your Neighborhood Dealer

Improve your receiving set with these high grade FROST-RADIO parts and accessories



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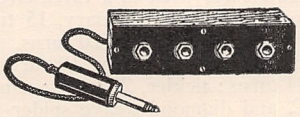
Pan-Tab Jacks.....65c to 90c
Standard Jacks.....45c to 70c

FROST-RADIO
No. 253—Automatic Cord Tip Jack 20c



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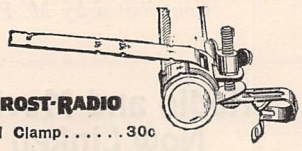
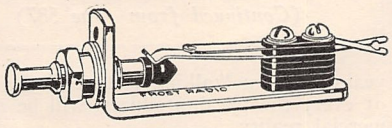
No. 501—Jac-Box, complete with cord and plug.....$2.50



FROST-RADIO
Ground Clamp.....30c



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Go to the radio store of your neighborhood dealer and ask him to show you these fine FROST-RADIO parts. Order from his stocks the items needed to put your receiving set in tip-top shape for the big broadcasting events which are coming. With FROST-RADIO parts you can make your old set work better, bring in the programs more clearly, and give you immensely greater satisfaction.

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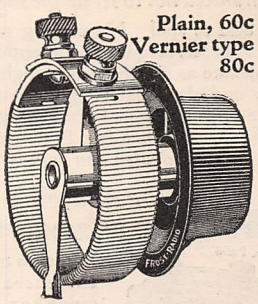
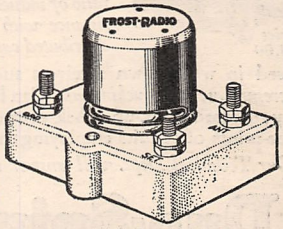


Plain, 60c
Vernier type 80c

FROST-RADIO
Metal Frame Rheostat



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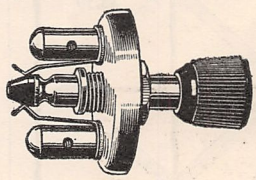

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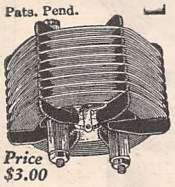

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Highly directional and very selective. Reduces static and helps to cut out interfering stations.

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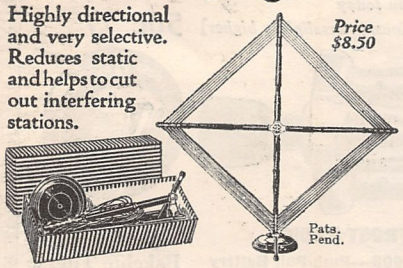

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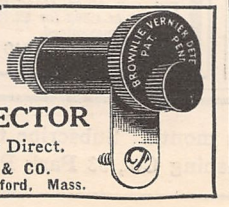

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ROLAND BROWNLIE & CO.
20 Saunders St. Medford, Mass.

Static and Weather Forecasting

(*Continued from page* 612)

radio instruments could not be accepted as reliable barometers to weather indications over a wide area, contend meteorologists. Weather forecasting is conducted according to zones or well-defined areas, and users of radio receiving sets, located in areas not far removed, have experienced dissimilar conditions, as they relate to "atmospherics" and radio reception, at the same hours. Furthermore, loop antennae with their sharp directional properties have at times demonstrated that atmospheric disturbances were prevalent in all directions, whereas a storm may have been in progress in one direction only.

These variable factors to the contrary, radio equipment is being used, in an experimental way, for detecting storms and the direction of their travel.

Radio Wrinkles

(*Continued from page* 631)

ferent aerial, it may be necessary to change the adjustment of the angle J. For an 11-plate condenser used in a three-circuit tuner, the constants are: Primary, 15 turns; secondary, 65 turns; tickler, 20 turns. For a 23-plate condenser: Primary, 10 turns; secondary, 44 turns; tickler, 20 turns; using No. 22 D.C.C. and diamond-weave spider-web coils. A variable grid leak is desirable, or if a fixed leak, the value should be 7 or 9 megohms for best results.

Contributed by M. P. Brogan.

Radio and Movies Now Linked

(*Continued from page* 587)

years ago that "talking pictures," the dream of every theatrical producer, will be a commercial reality.

Grand Opera by Wireless

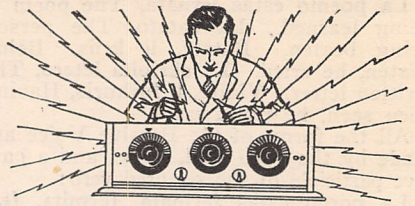
By HUGO GERNSBACK

Reprinted from September, 1919, RADIO NEWS

A RECENT newspaper report from Chicago brought the not at all surprising news that grand opera music had been transmitted by wireless telephone for over one hundred miles. Sensitive microphones placed on the stage of the opera house caught the sound waves; the impulses, then being stepped up in the usual manner by means of a transformer, were led into an amplifying vacuum tube. Here the current was impressed upon the radio telephone transmitter in successive stages and sent out over the aerial on top of the opera house. Wireless amateurs all about the surrounding country were thus able for the first time to hear grand opera. While this was only an experiment, grand opera by wireless will soon be an accomplished fact.

During the next few years it will be a common enough experience for an amateur to pick up his receivers between eight and eleven o'clock in the evening and listen not only to the voice of such stars as Scotti, Tetrazzini, McCormack and others, but also to the orchestra music as well, which is picked up by the sensitive transmitter along with the voice of the stars. The surprising

HENNINGER RADIO ENGINEER



Wizard of Radio
Contributes two more of his
MARVELOUS INVENTIONS

to the perfection of super-powerful R.F. amplification. These new inventions render a control of volume and clarity beyond anything ever offered before. Henninger's work is well known to everybody who knows radio at all and these two new inventions will be received with great enthusiasm. Don't do anything to your set until you get free descriptive literature of both of these inventions. And remember that both of these articles because of advanced design and volume of production are priced much lower than coils and condensers far inferior in effectiveness.

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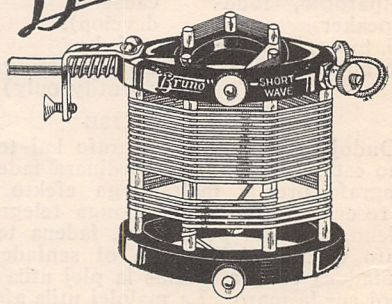

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thing is that it is not being done now.

The reason is probably the fact that as yeat no means has been found to reimburse the opera companies for allowing everyone to listen in. While of course listening to the music is not as satisfying as witnessing the performance in person, still many music enthusiasts would rather stay home listening to the music alone than to witness the performance itself. To your true, dyed-in-the-wool opera fiend the performance is of secondary importance, the music always coming first.

But we must give a thought to the management, which cannot subsist on an empty opera house if everyone could listen in to the actual rendering of the opera without paying for the privilege. Needless to say, the producers would soon find themselves bankrupt. For this reason we cannot expect that grand opera by wireless will be an accomplished fact until some means has been found to reimburse the producers, and, as every wireless man knows, this is very difficult to do. Anyone with suitable radio apparatus can "listen in" to the music without much trouble. No matter on what wavelength the music might be rendered, every wireless man could find a way to listen to it without serious inconvenience.

Probably the only logical way out would be for the management of a grand opera company to advertise in the newspapers, stating that no grand opera via radio would be given unless a certain amount of revenue were guaranteed by radio subscribers before "radio performances" would be given. This would mean that probably ten out of one hundred radio stations, amateurs and otherwise, would pay monthly or yearly dues to sustain the management, which then would not have to care how many were listening in.

This is the only practical solution. As for technical difficulties, there are of course none. All that is necessary for the producing company is to install a high-class wireless telephone outfit which can be bought on the market right now and which is immediately available. The rest is up to the wireless fraternity, which has nothing else to do but listen in.

At the receiving end, the future up-to-date radio opera enthusiast will, of course, have a first-class receiving outfit, using vacuum tube amplifiers, and a loud talker. Then it will be a simple matter to listen to Scotti himself, though he be a thousand miles distant. His voice will come out loudly and distinctly and the amateur's family will be able to "listen in" to their hearts' content.

There is still another novel scheme recently originated by the writer.

The underlying idea is not only to give grand opera by wireless, listen to the music and to the singers only, *but to actually see the operatic stars on the screen as well.* It can be readily accomplished *by means which are available today,* and without the slightest technical difficulty.

Let us say, by way of example, that the opera "Aida" is filmed in its entirety. This may mean a four or five film feature. The opera will be filmed just like any other photo-play.

Our large illustration shows what happens next. The stars, singers, players, the chorus, orchestra, conductor, etc., are then assembled in a moving picture studio and in front of them is the usual screen. The opera "Aida," which had been filmed before, *is now repeated on the screen* while the entire cast follows the screen picture closely. Each performer, every star, every member of the chorus has his or her own microphone in which he or she sings the regular score, watching closely the film-play as the action is unreeled on the screen. The moving picture opera, through the film

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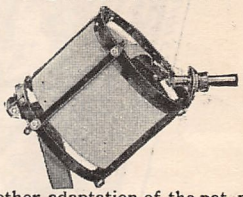

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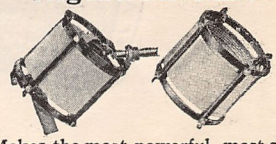

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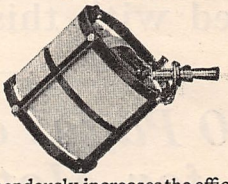

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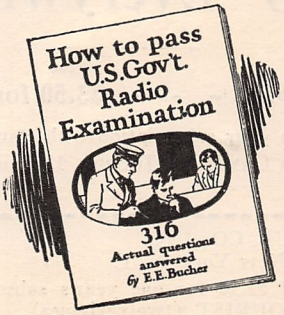

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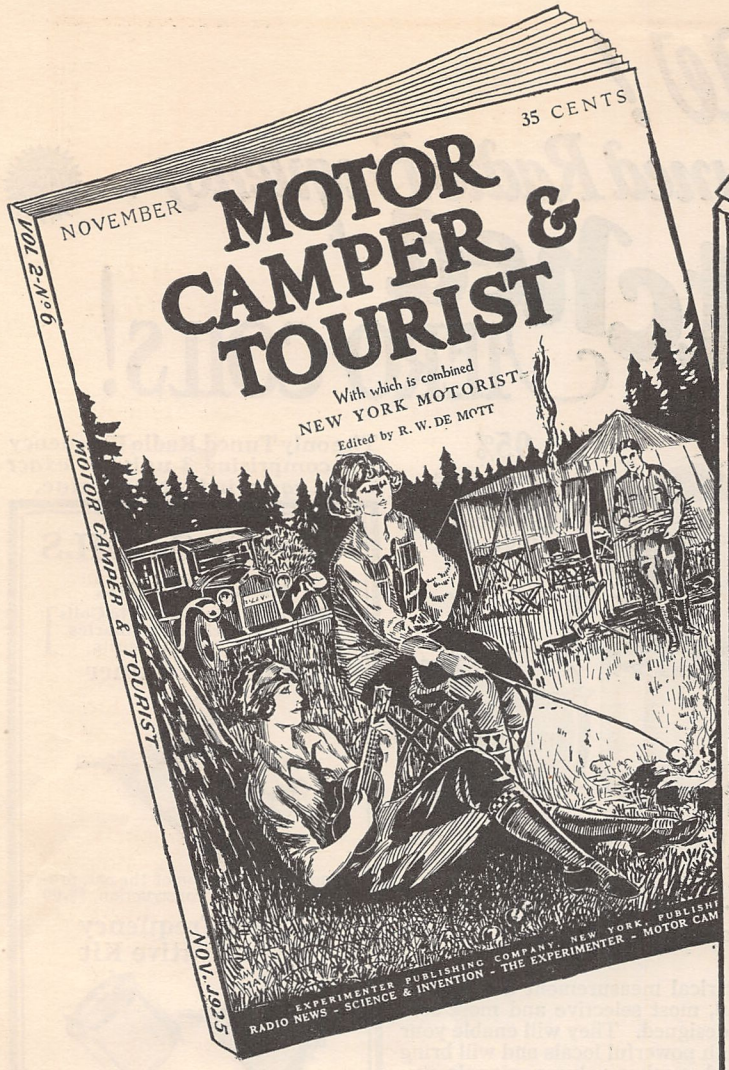

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operator, keeps time with the singers, and the singers themselves must keep exact time with the performance as it is unrolled on the screen before their eyes. Inasmuch as the identical cast has been filmed, it will not be difficult for them to keep time with their own performance, as may readily be imagined. *In other words, when Scotti sees his own figure appearing on the screen he will know exactly how and when to sing into the microphone in front of him.*

All of the microphones go to the wireless telephone station located in the radio room above, and there are, of course, sensitive microphones in the studio which pick up the sounds from the orchestra as well. All sounds are then stepped up through the usual amplifiers and are fed, into the high power vacuum pliotrons, *all of which finally amplifies the original sound several million times.* These impulses are then sent out over the usual aerial located on top of the house and are shot out all over the country instantaneously.

Five hundred to 1,000 miles away—and for that matter all over the country—every moving picture house will have been supplied with the identical film at the stated performance, it having been announced days ahead that the grand opera "Aida" will be given at such and such an hour.

Of course, where the distances are large, the hour rendering the opera will vary. Thus, for instance, if Scotti were singing in New York and a performance were to start at eight o'clock in the evening, New York time, it would start in San Francisco at four o'clock in the evening, *as a matinee,* due to the difference of time. Inasmuch as such performances would probably be held only once a month, people would not mind the inconvenience due to the slight difference of time.

Every moving picture house will have its receiving apparatus with its usual amplifiers and anywhere from six to one dozen loud talkers scattered through the house. Exactly at the stated time the moving picture operator will begin grinding away—the opera has begun. Simultaneously the distant orchestra will begin playing, filling the house with music.

When the actual performance begins, it will be an easy matter for the operator to keep time with the incoming music. All he needs to do is to grind faster or slower, and inasmuch as Scotti with his performers in New York is watching the identical film, the distant operator will have no trouble in having the music keep time with his film. If he finds that he runs ahead for one second, he can readily slow up the next and *vice versa.* With a little practice it will be easy for the distant operator to time himself perfectly, thus giving the patrons of his house an ideal performance.

From a financial standpoint it would be good business for the opera company, as well as for the moving picture house, *both of which would thus derive a new income, running into the hundreds of thousands, with hardly any expense.* The grand opera with an outlay of from one thousand to three thousand dollars could buy its high power radio telephone outfit, while every live picture house throughout the country would be able with an expenditure of less than five hundred dollars to buy its necessary radio telephone equipment *and this cost would be initial only,* because nothing except burnt-out vacuum tubes need be replaced and there is practically no cost of up-keep.

The writer confidently expects that this scheme will be in use throughout the country very shortly.

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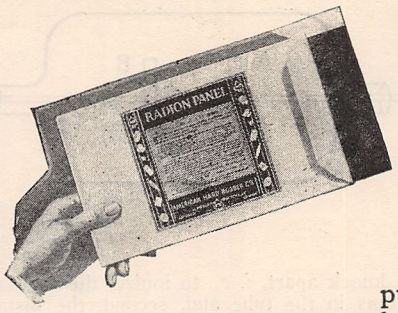

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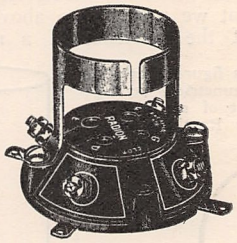
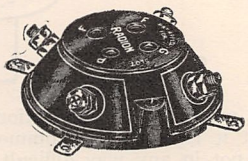


No. 2 Socket for new UX tubes with collar adapter for old type tubes. No. 3 same as No. 2 without binding posts.



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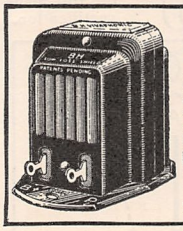

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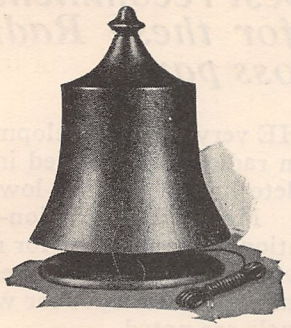

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The Raytheon Rectifier

(*Continued from page* 613)

Notice that two primary conditions must be met in order to keep up a gas discharge. First, a sufficient potential must be applied across the gap to give the electron projectile at least the minimum energy necessary

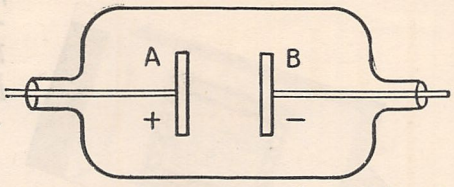


FIG. 1 A perfectly symmetrical tube does not permit rectification.

to knock apart, *i. e.*, to ionize, the particular atoms in the tube and, second, the distance of travel of the electron projectile between the electrodes must be at least equal to the average distance between the gas atoms at the pressure existing in the tube. If this second condition is not met, the electron projectiles will strike few or no atoms as they shoot across and thus no new ions will be formed. This second necessary condition is what we referred to above as the "principle of the existence of a minimum

This figure shows the asymmetrical arrangement of electrodes in the Raytheon tube.

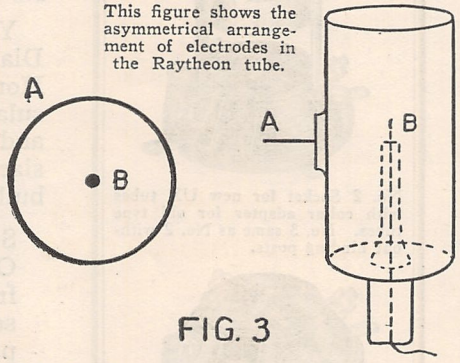


FIG. 3

path for the production of ionization." We now see that it is a simple, common-sense requirement, not in any way difficult to understand. In helium at a pressure of one millimeter of mercury the average path over which an electron must travel before hitting an atom is a little more than one millimeter.

It is evident that, because of the complete symmetry of the parts of the tube of Fig. 1, the discharge will pass as readily in one direction as in the other. If this tube were

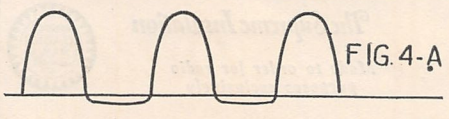
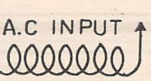


FIG. 4-A

Above: Imperfect rectification.



Below: Arrangement for full wave rectification.

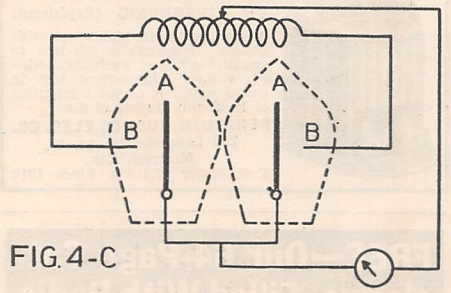


FIG. 4-C

Perfect rectification.

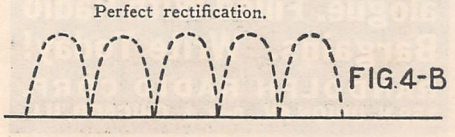


FIG. 4-B

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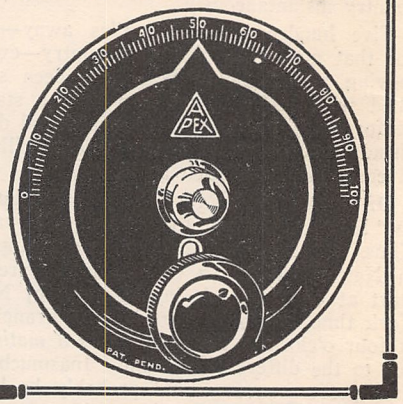

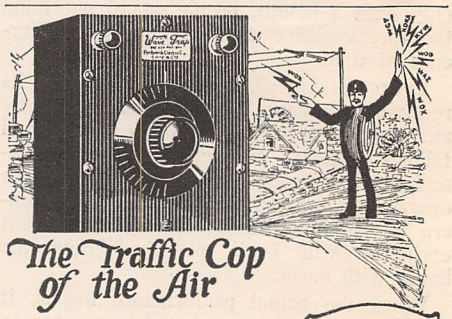

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put into an A.C. circuit, both half-cycles of current would pass equally well and no rectification whatever of the flow would occur.

Suppose, now, we have a tube built as in Fig. 3 with one plate, A, a large area cylinrer, say, an inch high and a half-inch in diameter, and the other, B, a short, fine wire on the axis of the cylinder. Here the area of A may be 500 times as great as that of B. The conductivity of the gap, AB, will now be found to be very different when A is positive to B than when A is negative to B. In the first case (A positive to B) a few *microamperes* will flow; in the second case (A negative to B) 250 or 300 or more *milliamperes* will pass. The reader is referred for further explanation of this fact to page 293 in the September RADIO NEWS. In order to start the flow in either direction a relatively high potential must be applied to the electrodes—not much less than 150 volts in any case—and always more when A is negative to B than when it is positive to B. It is obvious that a device with the unilateral conductivity here described will rectify A.C. nearly completely since, if proper attention is given to the magnitude of the applied voltages, 200 or 300 milliamperes will flow in one direction during the one half-cycle (with A negative) and only a few microamperes in the opposite direction in the second half-cycle. This rectifying action (Fig 4A) is explained in detail in my article in the September RADIO NEWS, where also reference is made to the necessity of filter circuits to smooth off the current humps and give a flow steady enough to be substituted for "B" battery current.

The first step in smoothing out the rectified current is, of course, to use two gas valves connected in parallel (Fig. 4C) just as in other rectifiers of all types, so that both current humps in the cycle are used. The action of this circuit can be readily understood from the figure, remembering that the terminals of the transformer become alternately positive and negative with reference to the center. The output of this combination resembles the current curve (Fig. 4B). It is evident from inspection of Fig 4C that the two valves could be replaced by a single one with two small area anodes and one large area plate and this is actually done in some rectifiers. Such an arrangement gives full wave rectification from a single tube.

It is, of course, desirable to eliminate the "back-current" through the rectifier (the little current loops below the line in Fig. 4A) as far as possible, since the ratio of "back current" to "forward current" determines the percentage of rectification. This end is accomplished by making the anode area as small as is practically possible compared with the area of the cathode.

The tube under discussion differs from other rectifiers of the same class mainly in the means taken to reduce the effective anode area and in the selection of a scientific design for insuring steadiness of action. Fig. 5 shows this tube diagrammatically. Here two anodes are used to secure full wave rectification by the method suggested above. These anodes are small wires, the tips only of which stick out of the insulation block. These anodes are completely covered and surrounded by the hollow cathode, the area of which is, comparatively, very large. Note that the cathode has two little necks which come down around and close to the stems of the anodes. The whole tube is filled with helium gas at a pressure of a few millimeters. The distance from the sides of the anode wires to the surrounding neck of the cathode is supposed to be less than the average distance between the helium atoms so that ions shooting across this gap cannot produce ionization since they hit few or no atoms.

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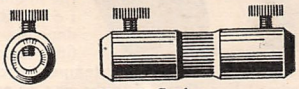

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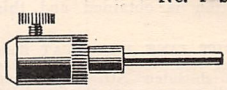

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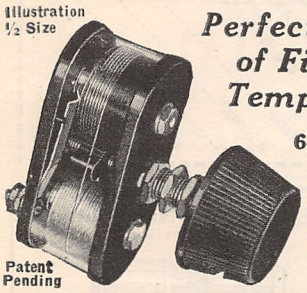

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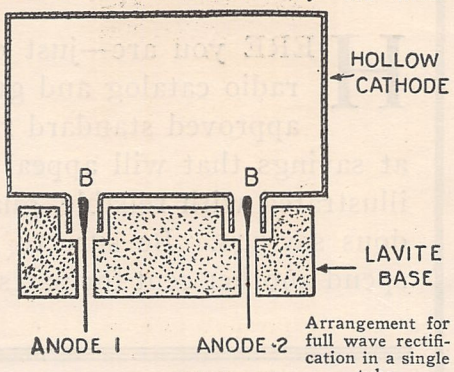
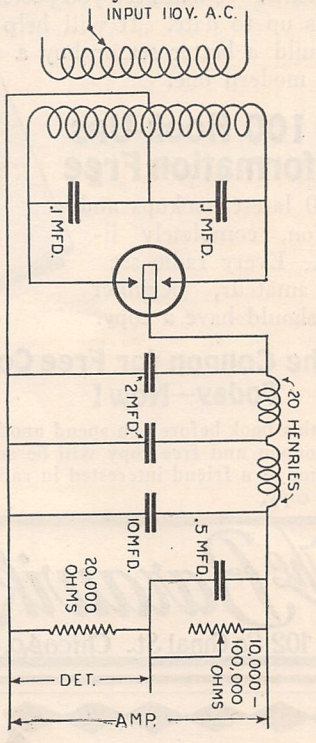
This limits the conduction to the very tip of the wires, from which the electrons can travel off on longer paths, and thus much reduces the effective area of the anodes. This is the novel feature of this new tube as a result of which the "back current" is claimed to be reduced to a minimum and a smoother, cleaner output is said to be obtained. A second feature that deserves mention is that the anodes are completely surrounded and shielded by the metal



Arrangement for full wave rectification in a single tube.

FIG. 5

cathode. This shielding protects the discharge from the influence of charges collecting on the glass and other insulating parts and prevents "wandering" and shifting of the ionic streams and consequent disturbances of the output current. These arrangements also protect the insulation at the bottom from the temperature and impact of the discharge and thus probably considerably increases the life of the tube.



Circuit diagram of the "B" battery eliminator, the photograph of which is shown on a preceding page.

The incorporation of the two featurees mentioned in this device (together with the use of two anodes) gives the tube an outstanding position amongst gas-filled rectifier bulbs for "B" battery eliminators. Since the safe conduction value of tubes of this type of moderate size is limited to a few hundred milliamperes it is evident that they have no application as "A" battery chargers or for similar heavy duty work.

A CORRECTION TO THE HISTORY OF RADIO INVENTIONS

In the July, 1925, issue of RADIO NEWS on page 52 under diagram No. 28 the caption should read: "Hartley Circuit. Circuit of 10-meter Generating Set. (By courtesy of U. S. Bureau of Standards.)"

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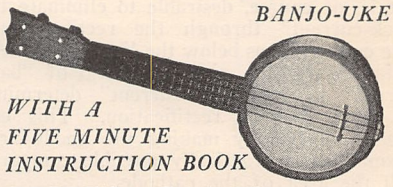

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Radio With the Rice Amazon Expedition

(*Continued from page* 589)

signals. Power conditions were the same in both cases. The distance is about 200 miles. The writer had an excellent opportunity to work stations during partial daylight and darkness on January 18, this year. 9ZT at Minneapolis, Minn., was worked during absolute darkness at Boa Vista. Gradually dawn appeared and then bright daylight about 6:40 A. M. 60th meridian time. The two stations, WJS and 9ZT, signed off. The only perceptible difference was an uncanny clarity in 9ZT's signal just at the crack of dawn. Over the remainder of the change in darkness to light no change could be noted.

The station WJS was, at this time, located in a fair clearing and the writer could see plainly the sunrise. As far as could be judged, there was no increase or decrease in the strength or fading of the signal.

An instance of wave jumping occurred when Station LR, after calling United States stations and hearing none answer, decided to quit on account of unfavorable weather conditions. But he heard, just as he was closing down, from a Canadian station. Later, in a letter from this station, the operator said: "I was surprised to hear you, have been unable to work stations in the States for the last week." It is quite obvious that our waves were skipping several thousand miles. The following night reception was again normal.

On the return to Boa Vista, in April, 1925, the writer tried for three nights, calling and listening for United States stations. The final night a station in Philadelphia took all traffic. The records on which the station were logged have been misplaced, but I take great pleasure here in saying that the Philadelphia man saved the day, for we moved the next day on our last leg of the journey home.

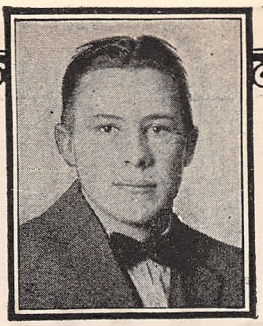
At the final semi-permanent camp, where the expedition changed from native canoes to smaller dug-outs belonging to the Indians, the radio equipment was left behind with other material.

When the party had returned to the other side of the five-mile portage the writer and the airplane mechanic journeyed over to prepare another canoe and send our numerous messages telling of the expedition's success in reaching its goal high up in the Parima Mountains that form the northern boundary of Brazil, forming the borderline between that country and Venezuela.

When the trunk in which the entire portable station had been packed was opened, it was found to contain multitudes of ants and their eggs. They had made homes between the condenser plates—in fact, everywhere in the set except inside the vacuum tubes. It was necessary to dismantle the entire transmitter and receiver and clean and dry all parts. Fate seemed to play a mean trick after our former success with the radio end of the expedition's work. Trouble began with the motor used to drive the generator. Finally Wilshusen gave up, after he had tried in vain to piece together various spare parts from several different motors. Thus the expedition moved down the river to Boa Vista, where again the elements seemed to conspire that no word might get through.

But, thanks to the station in Philadelphia, about six messages reached their destination, making known to the world that we were safety on the return voyage after the most difficult portion of the trip.

During one very hot night after the rain, when all kinds of insects had found shelter under the canvas roof over the portable set,



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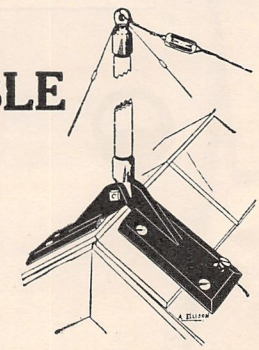

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it was necessary to keep blowing the terminals of the antenna series condenser to prevent the bugs from getting across it and destroying resonance in the antenna circuit. Immediately a bug touched one of the terminals its body would be cremated and form a short circuit for the high frequency current, which was at high potential through the condenser.

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Besides communications, radio played another important rôle in determining chronometer rates from the received time signals sent out from various government stations. Usually the press and time check from Balboa, Panama, NBA, was received. The morning's newspaper, containing world events and condensed and often unimportant news, was placed in a conspicuous location so members of the party could read it. The time check from NBA was found to be unreliable for extreme accuracy and so it became necessary to change and pick up the signals from NSS.

The long wave receiver consisted of three tubes connected in the usual manner and had a loop for its collector. Although rather out of the ordinary in constructional details, this receiver worked at all times, despite the drizzling rain and soggy ground on which it often rested. At times it would require a drying by the camp fire to drive the moisture out of the head-phones and loop.

The most interesting experience in obtaining the time check was brought about by the necessity of receiving the noon-time signals while under way in a small canoe bound down stream at a seven-mile per hour rate, dodging some rocks and hitting others. It was decided not to waste any time in going ashore, so the apparatus was set up and the operator cautiously stood in the canoe, supporting and rotating the loop of the set to maintain maximum signal strength. This was highly essential, as the canoe followed all sorts of crooks and turns in the river. Toward the last minute the loop was blown from its supporting frame by a strong wind and immediately the writer stretched forth his arms, grasping a piece of the loop in each hand and stood rigid until the final dash. Perfect checks were obtained, and no time lost on our downward journey.

Much experimental work was done at the Boa Vista station but most of the findings must be held for further investigation.

However, it can be stated that one important discovery was of the association of the presence of high winds with an increase it atmospheric disturbance. This, no doubt, directly follows the theory of dust moving at a high velocity giving rise to the atmospheric charges which affect radio receivers.

It can also be said that local meterological conditions have no perceptible influence on the reception of wave-lengths below 100 meters. Radio communication from South America to North America on short waves in the vicinity of 80 meters will not be as reliable during the summer months of North America. This fact cannot be attributed to any definite reason. Very radical conditions manifest themselves by completely trapping the short-wave signals for several days, later permitting them to come through with strength.

At present the author is constructing equipment to be used on a wave-length of 10 and 80 meters for Mr. Henry Field, who is going to Balboa in the fall.

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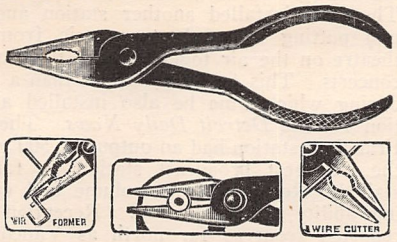

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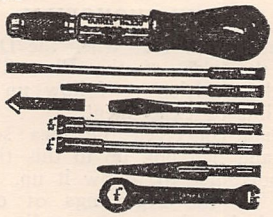

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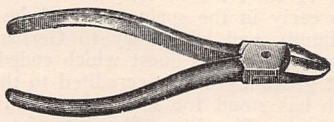

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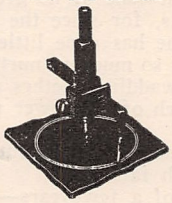

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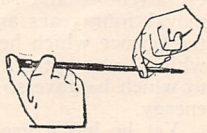

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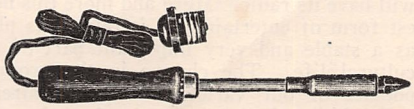

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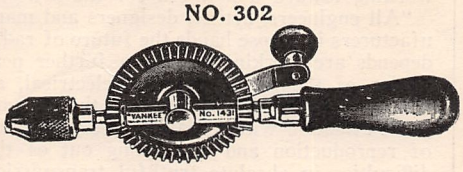

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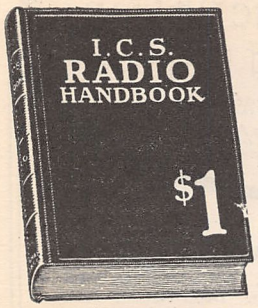

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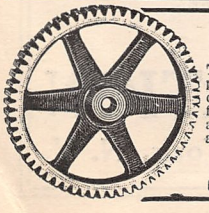


GEARS
All Kinds—Small

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalogue 40
Chicago Stock Gear Works
105 South Jefferson St., Chicago

The Life Work of Lee DeForest

(*Continued from page* 603)

The station at the *World* had been operating only a few months when DeForest and the radio inspector again ran counter to each other with the result that the station was closed.

For some time there had been a correspondence between DeForest and some engineers on the West Coast. It seemed that the California Theatre in San Francisco was interested in the new broadcasting stunt. Immediately the Doctor moved, laboratory and all, to the Golden Gate. There he installed another station and began putting the orchestra music from the theatre on the air together with the Sunday concerts. This lasted for more than a year, during which time he also installed a station for the *Detroit Daily News*. The San Francisco station had an output of 500 watts, the strongest broadcast station so far installed. Reports of its volume and carrying ability were pleasing. Reception was reported from as far north as Vancouver, B. C., and from as far east as the Sierra range mining camps.

THE PHONOFILM

It was late in 1920 when the Doctor conceived the idea of the Phonofilm—rather made the decision to follow up that particular line of experiment.

He had conceived the idea some years before and had not, up to this time, found the opportunity to follow it up. However, because of the beginnings of commercial interest in broadcasting, as well as some developments in his private affairs, he decided to start his investigations.

So early in the spring of 1921 he moved his family and laboratory to Germany and began a two year's quest which ended in the latest great invention accredited to the name which has stood for so much in radio—Lee DeForest. The Phonofilm is now more or less well known to all of us. Through it, radio lost—or almost lost—one of its greatest inventors and savants, for since the removal four years ago, he has done little in the science which he did so much to nurture while it was yet in its swaddling clothes and to which he gave so much of his power and energy.

Yet he has a great interest in the future of the art—and as much faith.

"It is only a matter of a few years—the time is almost on us now—when every home will have its radio. More and more this newest form of entertainment is taking its place as a stable and very important part of our cultural life. The change in the program policies of our various stations is already noticeable and we may say that they are working toward a new era for the art.

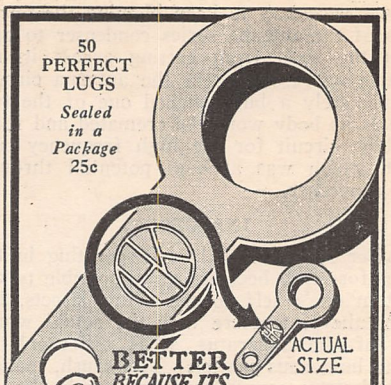
"All engineers, artists, designers and manufacturers in whose hands the future of radio depends are working toward a further perfection of the mechanical and electrical, as well as the artistic, side. From the present, great attention will be paid to the perfection of reproduction and an ironing out of the difficulties in absolute truthful transmission of all sound frequencies.

"As for the phonofilm, it will never, I think, become a household affair. However, it is not quite logical to be too definite. One of the greatest shortcomings of the movies has been overcome by the addition of the voice to the visual entertainment, so that, after all, the home movie may make its presence felt.

"The chimera of the present, radio movies, seems to me a little distant. Though it is being done in a rough way, I do not think that it will reach a commercially successful point for several years."

The end.

50 PERFECT LUGS
Sealed in a Package 25c



ACTUAL SIZE

BETTER *BECAUSE ITS*
Soddersdipt

They *pull* the sodder from the iron

KELLERADIO, Inc.,
821 Market St., San Francisco
Sole Distributors

HEINTZ AND KOHLMOOS
SCIENTIFIC APPARATUS
INC.

$3 brings you this genuine AMPL-TONE Loud Speaker Unit

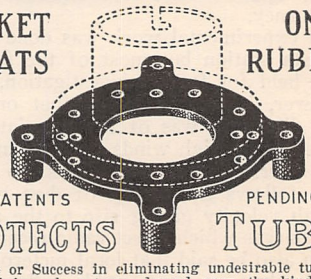
Ten days' free trial. Your Three Dollars unconditionally returned if at the end of ten days you are not perfectly satisfied with this Phonograph Attachment and do not find it to be of exceptional value for volume and clear reproduction.

Reverse the tips and note the difference in pitch. Will not de-magnetize. Phonograph people spent years perfecting the acoustic. Take advantage and use our unit on your phonograph.

UNION FABRIC CO.
(Makers of the French Headset)
DERBY, CONN.

ILLINOIS SOCKET CUSHION

SOCKET FLOATS ON RUBBER



PATENTS PENDING

PROTECTS TUBES

Failure or Success in eliminating undesirable tube noises and obtaining clear tones depend upon the kind of tube mounting.

Illinois Cushions are moulded of pure gum rubber that absorb vibrations that would otherwise reach tube and are the best shock absorbers, practically indestructible.

Rubber feet raise the socket off of panel and suspend it like a suspension bridge. Cushions are not a mere pad or washer, but moulded to form to easily attach to any socket, round or square, for large or small tubes. Held to socket by 2 small screws and nuts.

Price 35c each or 3 for $1.00 Postpaid.

ILLINOIS RADIO CO.
800 S. 4th St. Springfield, Illinois

RICHARDSON
RECEIVERS ACHIEVE RESULTS
Factory and Executive Offices:
Foster Avenue & Hulst Street, Long Island City

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate twenty-two cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the January issue must reach us not later than Nov. 1st.

CIRCULATION LARGER THAN THAT OF ANY OTHER RADIO PUBLICATION

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

Big Money and fast sales? Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

Guaranteed Genuine Gold Leaf Letters anyone can put on store windows. Large profits, enormous demand. Free samples. Metallic Letter Co., 422 N. Clark, Chicago.

Big Money—fast sales; everyone buys gold initials for their auto; sell $1.50, profit $1.44. Ten orders daily easy. Samples, information free. World Monogram, Dept. 27, Newark, N. J.

Agents. $100 a week paid to men who will help me in spare time in local assembly of amazing new kind of 5-tube radio set. I show you how. Demonstrator set given free. No capital needed. Write quick for details of work. Frank Condon, Dept. 12-P, 2632 Prairie Ave., Chicago.

Agents—Big Profit, Wonderful Little Article. Something new; sells like wildfire. Carry in pocket. Write at once for sample. Albert Mills, Manager, 4203 American Building, Cincinnati, Ohio.

Earn $10 daily Silvering Mirrors, plating, refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. Bolanger-Decie Laboratories, 1133 Broadway, New York.

Bankrupt and Rummage Sales. Make $50.00 daily. We start you, furnishing everything. Distributors, Dept. 213, 509 Division, Chicago.

Agents—good steady income. Exceptionally useful household article. The Handycap Company, Newark, N. J.

$13.50 daily (Sworn Proof Furnished). Introducing New Insured Hosiery for men, women, children. Seven pairs guaranteed seven months. No capital or experience required. We teach you. We deliver and collect, or you can deliver, suit yourself. Credit given. Outfit free. Macochee Company, Station 47411, Cincinnati, Ohio.

Agents: $300 - $500 monthly easy taking orders for Morey Rim Tool. Autoists and trade buy on sight. L. Morey Rim Tool Company, Blissifield, Mich.

Business Opportunities

Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 813 Washington Blvd., Chicago.

$50 a week. Mail Order Business. Free booklet tells how. Sample and plans 25c. Free $3 worth of articles. Gelhaar, A4261 Broadway, Chicago, Ill.

Responsible manufacturer wants competent men to manage office and salesmen. $300 to $1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

Free Book. Start little Mail Order Business. Pier, 996 Cortland Street, N. Y.

We establish any honest man, regardless of inexperience or limitations, in his own profitable, fascinating radio industry. Radionola, Tribune Building, New York.

Open a Radio Store. Make $300 to $500 monthly. Mail postal and learn How. Address Radio, 70 E. 18th St., Chicago.

Make Money! 150 Plans FREE! Wolverine Bureau. (D-1) Muskegon, Michigan.

$100 weekly up. We want experienced Radio men to operate branch assembling plants. Part or whole time. Barfield Radio Co., 13 Tillery Street, Dept. N.R., Brooklyn, New York.

$50 weekly evenings. Mail Order Business. Booklet tells how. Sample and plan 25c. Free—9 articles worth $3. E. Bradford Co., Shawnee, Okla.

Chemistry

Chemistry supplies catalog 5c. Chemical Apparatus Co., 4402 West End Avenue, Chicago.

Educational

Used Correspondence School courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d St., New York.

Electric Motors

Motors $2.98; Good, practical, twentieth horsepower, 115 volt alternating—direct current. Tenth horsepower $3.98. Order Now. Pay Postman. Perry Trading Company, Dept. N11, 815 Lake, Racine, Wis.

Exchange

Radios for Cameras. Liberal allowances made for Kodaks, Cameras, Binoculars, Office Equipment, and Electrical Household Appliances in trade on Radio Sets. Ar-Te-Co Radio Exchange, Ottawa, Ill.

200-20,000 meter Receiver Radiotron $25.00. Smith, 4416 Market, Philadelphia.

For Advertisers

24 Words—355 Rural Weeklies $14.20. Admeyer, 4112-R Hartford, St. Louis.

Help Wanted

Men to build radio sets in spare time. Leon Lambert, 595-H Kaufman Bldg., Wichita, Kansas.

Detectives needed everywhere; large salaries; free particulars; write National Headquarters, 188 East 79th, New York.

All men-women, 18-65, wanting to qualify for Government Positions, $140-$300 monthly, write Mr. Ozment, 251, St. Louis, Mo., immediately.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968 Broadway, N. Y.

Earn $25.00 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 972 St. Louis, Mo.

Incorporations

Delaware Incorporator. Charters; Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Del.

Miscellaneous

Gummed Labels, Name and Address, 500, 2 lines 30c, 3 lines 50c. Catalogue. Eastern Label Co., X Clintonville, Conn.

Gummed Labels—3000 $1.00. Catalog 2 cts. MacTaggart, 1237 Arch, Philadelphia, Penna.

Motion Pictures

Films for Toy Machines. Hart—Mix-Chaplin. Complete stories 1000 feet $3.50. Special 200 foot lengths $1.50 postpaid. Big Boys list Free. Monarch Films, Department 3, Memphis, Tenn.

Motorcycles, Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Old Money Wanted

$2 to $500 each paid for hundreds of Old or Odd Coins. Keep all old money, it may be very valuable. Send 10c for New Illustrated Coin Value Book, 4x6. Guaranteed prices. Get posted. We pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278 Enright, St. Louis, Mo.

Patent Attorneys

Inventors—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Inspection and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, N W., Washington, D. C.

Inventors—who derive largest profits know and heed certain simple but vital facts before applying for patents. Our book Patent-Sense gives those facts; free. Write Lacey & Lacey, 631 F St., Washington, D. C. Established 1869.

Personal

Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Radiumact Removes Warts, Moles, Superfluous Hair, Coal, Powder and Tattoo Marks. Particulars sent free. Radiumact Co., 1416 Cadwallader St., Philadelphia, Pa.

Printing Outfits and Supplies

Print your own cards, stationery, circulars, paper, etc. Complete outfits $8.35; Job Presses $12, $35; Rotary $150. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Press Company, A-13, Meriden, Conn.

Radio

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalog. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal, 75c prepaid. Send for yours today. Radio Specialty Company, 96-98 Park Place, New York City.

Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, New York City.

Radio (Continued)

Make Your "B" with Edison Elements. They last a lifetime. Pair 5 cents; welded, 7½ cents postpaid. Henry Chapelle, Woodburn, Ore.

Ivory Radio Panel: Grained white "Ivorylite" makes most beautiful set of all. Guaranteed satisfactory. Any size 3/16 in. thick. 3c per square inch. Sample free. Ivorylite Radio Panel Co., Dept. N, 3222 Ave. F, Fort Worth, Texas.

Supersensitive Galena Crystals, pound $1.00, prepaid. Alkemite, All-sensitive Crystals, 50c. Buskett, Joplin, Mo.

$1.00 For Your Old Tubes regardless of make or condition towards the purchase of each new Standard $2.50 tube. Positively guaranteed. We do not sell rebuilt or bootleg tubes. Order today. Luxem & Davis Mfg. Co., 6229 Broadway, Chicago, Ill. Agents Wanted. Paste this ad in your set.

Write Lambert first! Don't buy one until you've read "The Truth about Radio." Sent free. Write Leon Lambert, Wichita, Kansas.

Magnet wire. Silicon Transformer Steel No. 12 D.C.C. wire 58c lb. add 4c for each size up to No. 20, No. 34 Enamel 1.26. Silicon Transformer Steel .014 26c lb. cut in desired strips, 4 cubic inches pr., lb 100 ft. No. 12 Enameled Aerial wire 85c Postage extra. Morton Elec. Co., 4832 Rice St., Chicago, Ill.

Now that you have seen the prices of the radio sets in this magazine—don't buy until you get our price list. Albert Muzik—P.O. Box 354, Bound Brook, N. J.

Turn back and read ad on TUNE-RITE Dial. Doubles the value of your set by giving straight line frequency characteristics to any condenser; separates stations exactly where they should be separated. Cost $3.50 each or $10 for 3 on receipt of cash or money order or C.O.D. Get yours now without waiting, from O-B-M Radio House, Suite 601, 6 Church Street, New York.

Edison Alkaline Storage "B" Battery elements 90 volts $5., 150 volts $8., instruction for assembling and charging with order. E. Parker, Putnam St., Peabody, Mass.

New Crosley Sets. Latest Kits and Parts. Complete list for stamp. Ray Radio Supply, Box 317, Sandusky, Ohio.

Super Radio Ore, tested best, bulk or cut crystals. Tiffany Jewel Mountings increase volume of any mineral. Samples Free. Chapman Radio Co., 314 Pacific Bldg., San Francisco, Calif.

Bargains: Crystalstat panel mounting detectors 95c. Carborundum fixed detectors 85c. Crystalstat mounted crystals 20c. Crystalstat lowloss receiving set $1.25. Lowloss variocoupler $1.25. All Prepaid. Breckenridge Electric, 1923 Lysander, Detroit.

Radio Experimenters send for free bargain list. Robert Bedford, Johnstown, N. Y.

Bargains—Zenith Model 3R—4 tube—$100. Zenith 4R—4 tube $60.00. New sets—guaranteed, if C.O.D. 10% must accompany order. Amateur Radio Supply Co., 525 Park Ave., Kent, Ohio.

Salesmen Wanted

Oil or Coal— "The Burning Question," interesting booklet, discusses high efficiency low priced residence oil burners. Copy free. Write E. L. Miller, Manufacturer Climax Burners, 53 Climax Bldg., Kansas City, Mo.

Skat Sales Agents Wanted. All or Part Time for Skat Hand Soap, Metal Polish, etc. Strictly Commission. The Skat Company, Hartford, Conn.

A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

Salesmen calling on radio trade for profitable, non-competitive accessory. Address Rovim Co., 318 Friendship, Providence, R. I.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Song Writers

Songwriters: Let me furnish the music for your songs, guaranteeing you absolute satisfaction. Copyrights secured. Submit your scripts for estimate and free advice. Walter W. Newcomer, 1674 Broadway, New York.

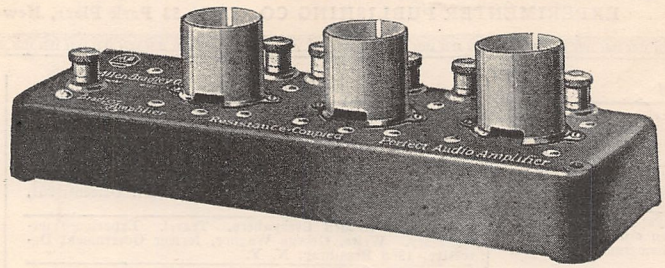
Telegraphy

Telegraphy—Both Morse and Wireless taught thoroughly. Big salaries. Wonderful opportunities. Expenses low; chance to earn part. School established fifty years. Catalog free. Dodge's Institute, Cour St., Valparaiso, Ind.

Wanted to Buy

Full Value Paid for Old Gold, Jewelry, Watches, Diamonds, crowns, bridges, dental gold, silver, platinum, gold or silver ore; magneto points, old false teeth. Packages returned if our offer is not satisfactory. United States Smelting Works (The Old Reliable) 39 So. State St., Dept. 16, Chicago, Ill.

Marvelous Tone Quality



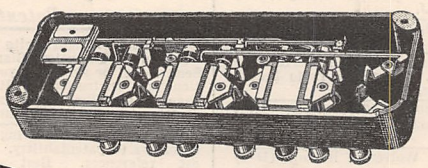
Enjoy Amplification Without Distortion by Installing a Bradley-Amplifier

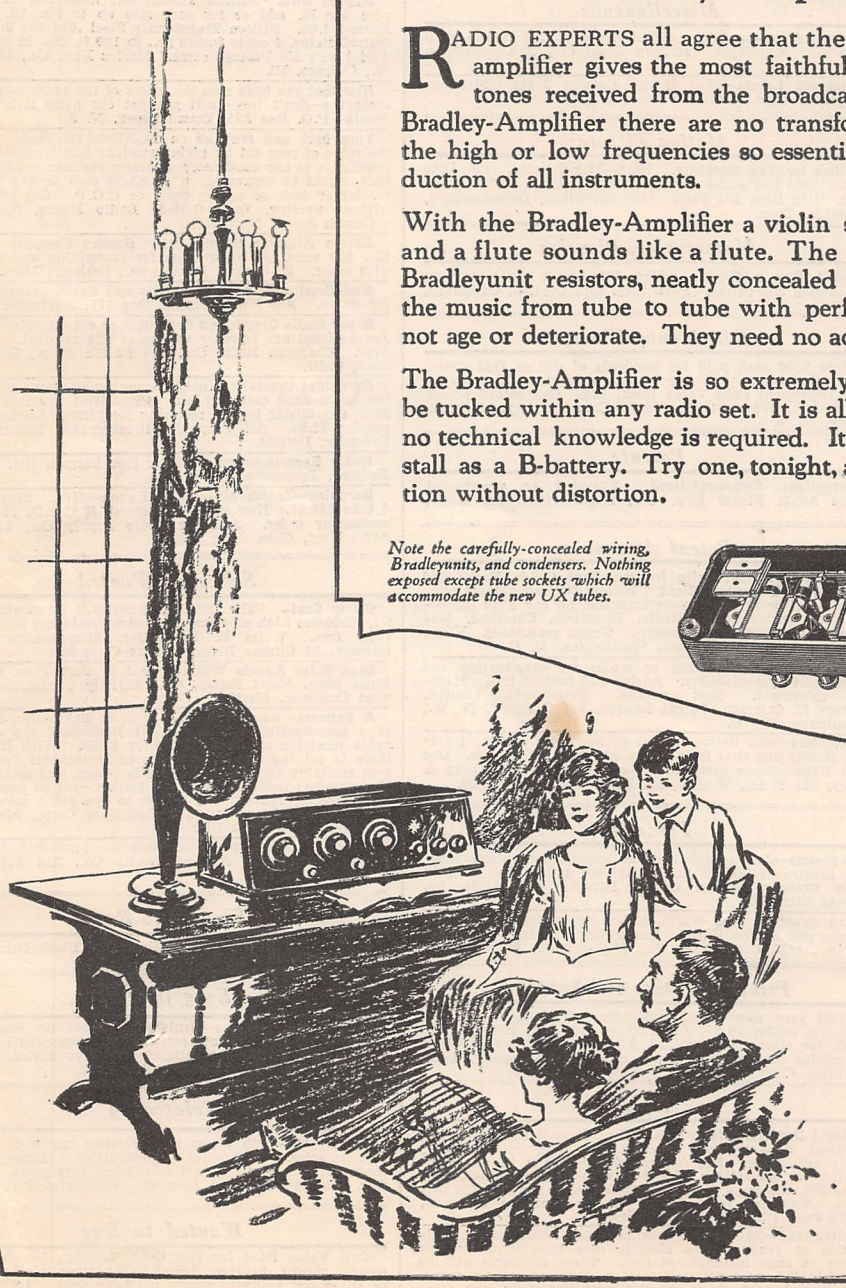
RADIO EXPERTS all agree that the resistance coupled amplifier gives the most faithful reproduction of all tones received from the broadcasting station. In the Bradley-Amplifier there are no transformers to choke out the high or low frequencies so essential for perfect reproduction of all instruments.

With the Bradley-Amplifier a violin sounds like a violin and a flute sounds like a flute. The perfectly-balanced Bradleyunit resistors, neatly concealed in the base, transfer the music from tube to tube with perfect clarity. They do not age or deteriorate. They need no adjustment.

The Bradley-Amplifier is so extremely compact that it can be tucked within any radio set. It is all ready to connect—no technical knowledge is required. It is just as easy to install as a B-battery. Try one, tonight, and enjoy amplification without distortion.

Note the carefully-concealed wiring, Bradleyunits, and condensers. Nothing exposed except tube sockets which will accommodate the new UX tubes.





Use the

Bradley Amplifier

PERFECT AUDIO AMPLIFIER

Manufactured by

Allen-Bradley Co.

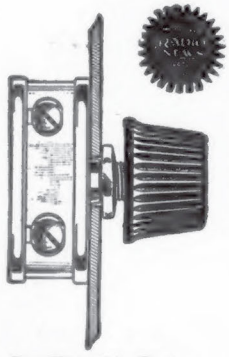
Electric Controlling Apparatus

287 Greenfield Avenue

Milwaukee - Wisconsin

PRINTED BY GILES PRINTING CO., LONG ISLAND CITY

There's a Real Thrill
in trying a New Hook-Up!



Bradleystat—Perfect Filament Control for All Tubes.

EVERYONE in the family is eagerly waiting to hear the new set! After hours and hours of drilling and soldering, the set is nearly ready for its first crucial test.

Will it meet with your expectations or will it be a disappointment? That depends upon two things—first your workmanship, and second, the quality of the parts used.

Good workmanship is the result of patience, but good parts are assured only by demanding well-known, guaranteed products, such as Allen-Bradley Perfect Radio Devices. Allen-Bradley Products are known the world over for exceptional performance and fine appearance. They eliminate the hazard and disappointment that follows the use of inferior radio products.

Ask your dealer for Allen-Bradley Perfect Radio Devices if you value your time and labor. *They always work!*

Bradleyohm—Perfect Adjustable Resistor.

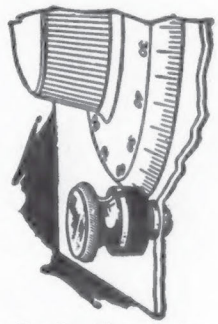
Bradleyunit—Perfect Fixed Resistor.

Allen-Bradley Co.

Electric Controlling Apparatus

287 Greenfield Ave. A-B Milwaukee, Wisconsin

Mfrs. of Graphite Disc Rheostats for Over 20 Years



Bradleynier—Perfect Vernier Knob.

Bradleyswitch—Perfect Battery Switch.

Bradleyleak—Perfect Grid Leak ½ to 10 Megohms.

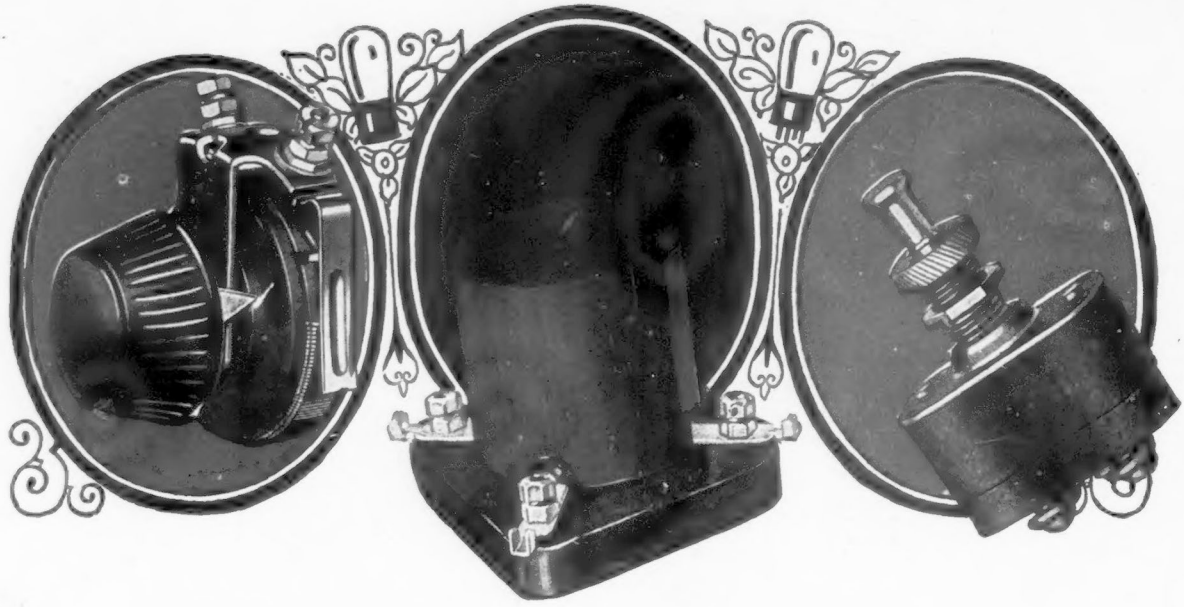
Bradleyometer—Perfect Potentiometer

ALLEN-BRADLEY CO.,
287 Greenfield Ave., Milwaukee, Wis.

Please send me your latest literature on the complete Allen-Bradley line of Perfect Radio Devices.

Name .....

Address .....



Give Your Tubes a Chance!

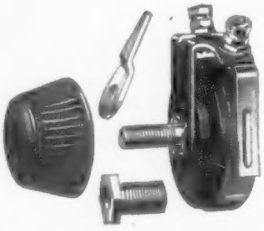
For Real Efficiency Say "Cutler-Hammer" When Buying These Vital Parts

The very heart of any radio set is the vacuum tube. Its ability to function properly decides to a large extent the range of your set and the quality of your reception.

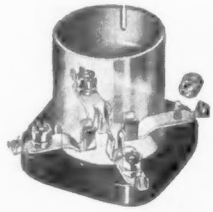
The Cutler-Hammer engineers have given lengthy study to the design of radio parts vital to tube efficiency. In the new Perfected C-H Rheostats are found features never before obtained. They give marvelously smooth, quiet control with an accuracy that is not disturbed during mounting of the instrument or after continued use. They make set building easy, anchoring absolutely rigid in a single hole in the panel. They add much to the quality of any set—and yet are lower in price.

Likewise, you can put the C-H Low Loss Socket [acclaimed by many engineers as the most perfect socket ever designed] in your set for maximum results, and actually save money in doing so. The same holds true for C-H Radio Switches—switches with real radio mechanisms that have so completely met the approval of the radio public that more than a million are in use today.

Before you build your new set, decide on *quality* parts. You will be interested in the folder "Radio Parts for Performance." Write for it—it's free.



The Perfected C-H Rheostats are of the revolving drum type, designed with the operating parts as a unit. They are not dismantled for mounting, and hence all spring tensions, adjusted at the factory, are undisturbed. They are of unusually convenient small size, and are rated at 6, 15 and 30 ohms to handle all tubes and their combinations.



The revolutionary design of the C-H Low Loss Socket created a sensation everywhere. Thin ORANGE Bakelite shell. Base of heatproof Thermoplax—terminals cannot loosen under heat of soldering iron. One piece contact springs integral with soldering lugs. Contacts grip both sides of each tube prong and are SILVER plated to prevent corrosion losses. Preferred by careful builders at 90c—now 60c because of huge production savings.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies

Works: Milwaukee and New York

Say

C-H

CUTLER-HAMMER

Buy Your Radio Parts by Name